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The Burleigh Rock Drill, and Air Compresser.

THE subject of rock drilling by machinery is one of the greatest importance in these days of railroad and canal building, of magnificent tunnels and extensive mining operations.

While the appliances for handling and transporting large masses of solid rock are many of them of ancient date, the machinery adopted to rock drilling is of very recent origin, though it has already reached a great degree of perfection, as is evidenced by the fact that so many great works are now being prosecuted by the use of pneumatic rock drills. We propose to give a description of the Burleigh rock drilling machine and air compresser, manufactured by the Burleigh Rock Drill Co., Fitchburg, Mass, whose advertisement appears in another column of this journal.

The Burleigh Patent Pneumatic Rock Drill is a machine designed for tunnelling, mining, quarrying, and sub-marine drilling, which combines the advantages of simplicity of construction, great strength of parts, compactness and lightness, weighing from 200 to 1000 lbs., according to size, and designed for drilling holes from ⅞ to 5 inches diameter.

It is convenient, easily handled, and not liable to get out of repair, and is in every respect the most practical drilling machine ever invented. It will drill from two to six inches per minute, according to the hardness of the rock. The drill-points used with the machine will make TEN times greater advance at each sharpening, than when used in the ordinary manner, by hand and sledge. This is proved by records kept at the Hoosac Tunnel, where these machines have been in constant use, night and day, for the last five years. This machine is so constructed that the piston bar is the only part of the machine which receives the shock resulting from the blow upon the rock. This piston bar, to which the drill-point is directly attached, is made from a solid bar of cast steel. With a pressure of 50 lbs. to the square inch, the drill strikes the rock from 250 to 300 blows per minute. The machine is provided with an automatic feed and rotating device, by means of which the drill is partially rotated at each stroke, and advanced toward the rock as required. The machines vary in size from 38 inches length, and cross section of 12x6½ inches, to 105 inches length, and cross section of 15x13 inches, and will feed forward without change of drill-points, from 19 to 54 inches, according to size of machine. By changing drill-points, any depth required may be drilled. The machine can be operated either by steam or compressed air. In tunnels and deep shafts, the air is preferable, as it serves the double purpose of power and ventilation. The compressed air or steam, is conveyed to the machine by means of a flexible pipe or tube, which is easily removed when blasting. The machine will drill equally well at any angle of direction.

THE BURLEIGH DRILL.—Fig. 1.

The introduction of these machines has now become quite general; they are in use in all parts of this country, and have also been introduced in England, Ireland, Sweden and Italy. Some of the largest works in this country are being prosecuted by them, such as the Hoosac Tunnel in Mass., the Nesquehoning in Pa., (just completed) the Lewis Tunnel in Va.—and several large tunnels in Colorado and Nevada. We are informed that several of the best copper mines in the Lake Superior region do their entire drilling with these machines.

To come nearer home the gigantic work of driving 13 tunnels under the reef at Hell Gate, which Maj. Gen. NEWTON is so successfully prosecuting, is being done largely by the use of 10 of these drills.

Fig. No. 1, represents one of the drills mounted on a very simple device, an iron tripod, which answers for surface, shaft and open cut work. For quarries a simple frame on wheels is often used.

Fig. No. 2 represents the drills as mounted for work at the tunnels at Hell Gate.

This carriage is constructed of wood and iron, and runs upon iron wheels.

It has jack screws to raise it from the wheels during the drilling, and is held in place by screws running out from the ends of the upper bar, or from the frame, to the roof of the tunnel. A tunnel 8 feet in hight and from 10 to 16 feet wide can be constructed by the use of this carriage.

Fig. 3 represents the Burleigh air compresser used for driving the drills in tunnels, there being five such machines at work at Hell Gate.

It consists of a steam engine connecting by means of a crank shaft with two single acting air pumps. It is compactly built, and said to be the best thing yet designed for furnishing the air wanted for the many uses it is now being put to.

Thirteen (13) of the largest size of these machines are now running night and day to supply the requisite pressure of air in the immense caisson of the New York Bridge Co., now being sunk at Peck Slip, and fifteen of them are at use at Hoosac Tunnel.

The feasibility of compressing air at any convenient point, and conveying it in iron pipes exactly as gas or water is carried along the streets of our cities to be tapped and used whenever required, has already been demonstrated; and it cannot be doubted that ere long the plan will come into extensive use.

The drilling machines and compressors, here described, may be seen in operation at any time at the work at Hell Gate. Steamers for that point leave Peck Slip nearly every hour.

Some Surface Characteristics of Fissure Veins.

BY T. F. VAN WAGENEN, M. E.

In the silver belt in which the writer has had most chance for observation (that of which Georgetown is the centre) the depth of surface soil or slide, and its relation to the inequalities of the mountain side are powerful agents in the determination of the direction, size and paying qualities of a vein. Especially are these effects conspicuous on what are known as "Hog Backs," when the formation of the hill slope resembles a pair of stairs, or in section, the toothed edge of a saw, one cliff rising back of another and terminating in a sugar loaf at the top.

It is in crossing these cliffs where there is the full-

est chance for variation in the depth of slide, that a vein becomes most distorted and irregular in its course, in one place showing an open crevice standing but a few degrees from the perpendicular, and fifty feet away, laying nearly flat, and pinched up to practically nothing.

The Meteor, at its discovery shaft, crosses a Hog's Back, on both sides of which are flats, where the crevice has been partially traced. The discovery is immediately under a cliff, and the vein is pinched, showing little or no mineral: 150 feet west, the vein emerges from under the cliff, and immediately expands into a pocket, from which a large amount of valuable ore has been taken: 50 feet further the lode again passes through a cliff, and in the two places where it has been struck is pinched to one and two inches.

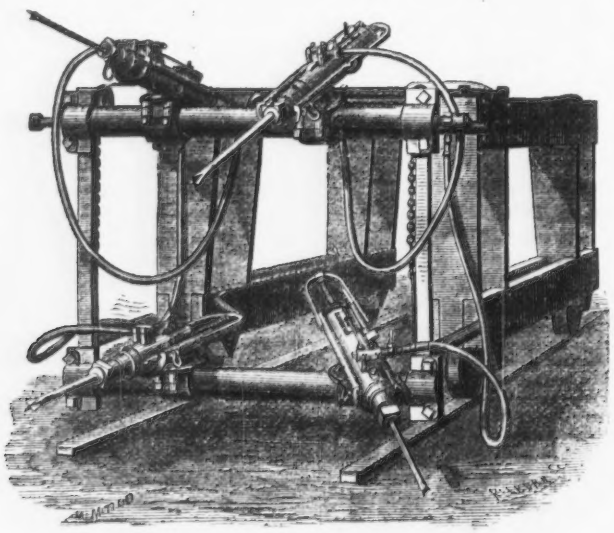
Why a vein should narrow from one or two feet to as many inches, in these cases, is a question for which one can hardly find a satisfactory answer among the miners. Their theory is that the crevice is compressed in the doubling up of the rock, but this is manifestly an untrue explanation, since it necessitates the formation of the crevice and its filling while the bed rock was yet in a plastic state. A reason nearer the truth seems to be that in these stair-like formations of the mountain side, the mass of rock is more solid and tightly wedged than usual and will yield less to the distending force below, which produces the fissure. This theory seems to be partially confirmed by the fact that on Hog Backs, as a rule, the rock blasts harder, and with more irregularity, than on a regular slope.

The second cliff passed, the Meteor again opens out and continues free for two or three hundred feet, the slope of the mountain being regular and even. East of the discovery, the same characteristics are even more noticeable. For 50 or 100 feet, the vein is close and unproductive, but beyond opens into a crevice of unusual width and richness. For 80 feet the walls are from 12 to 40 inches apart, and filled with solid galena, running from 500 to 1500 ounces to the ton.

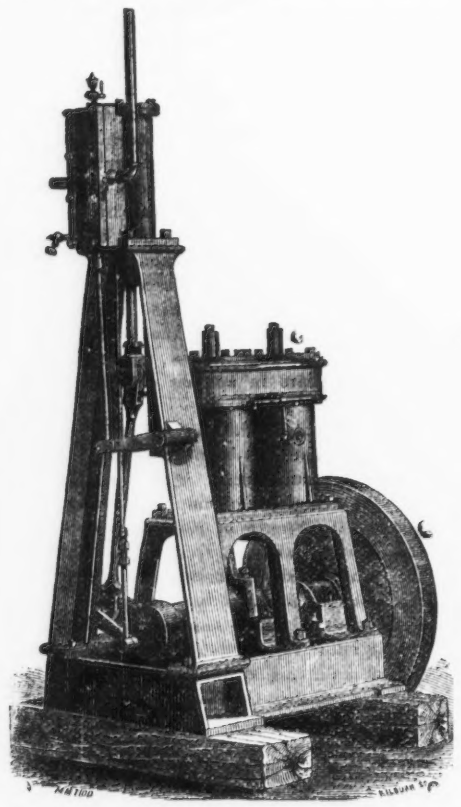
Several interesting cases of great slides are to be found around Georgetown; one of the most striking being that on Summit Mountain, and around the discovery of the famous Anglo-Saxon lode, which was probably the richest deposit of silver ore that has ever been found. The crevice was found standing, in good condition, with clearly defined walls, and apparently in solid bed rock. The ore was nearly pure sulphuret, giving the wonderful yield of 22,000 oz. of silver per ton, 32,000 oz. being equivalent to the solid metal. Over 100 tons of ore were taken from this pocket, and the owners considered their fortune secure, when suddenly the crevice ended abruptly and completely, like a break in a coal bed. Since then (the discovery was in 1866) the most rigorous prospecting has failed to find the crevice again. Wherever there has been the slightest chance of striking it, search has been made, for the stake was valuable enough to warrant almost any expense. Shafts have been sunk, and tunnels run hundreds of feet into the mountain; but so far with no paying results. There are other veins of minor importance in the same locality as the Anglo-Saxon, which have been found to end as abruptly as the Great Lode, and probably owing to the same cause. But somewhere in the heart of the mountain the main vein will be found by the man who has the pluck and money to open a tunnel low enough down and to push it forward steadily and perseveringly. The striking of the vein is a certainty, that is, so far as one can reason by analogy, though when struck, it may bear no comparison in value to the almost fabulous deposit on the surface.

On Summit Mountain undoubtedly a slide of unusual depth and extent has taken place, different from the mass of debris which usually forms the surface soil on all the mountains. The solid bed rock has slipped from its ancient foundations and carried along with it, in an almost unbroken condition, the upper part of all the crevices within the extent of the slide. When such a break occurs, on a mountain top where rain and frost have every chance to obliterate all traces of the direction and area of the fall, the usual means of following it up are not available, as in the case of the moving of one stratum above another.

Upon Leavenworth Mount close by the shaft of the Equator Lode, is a patch of slide rock and soil, which has for some time been known as the Equator Slide, and from which a large amount of very rich galena has been taken. The first genuine excitement on the ground was the discovery by a prospector of a mass of solid ore weighing nearly 500 pounds, and valued at 42 cents per pound. No crevice was found near it, and no indication of any beyond this immense piece of "float." The bare mountain side instantly rose in value, and was claimed by miners in patches 100 feet square. More broken crevice matter was struck, some men making as high as $50 per day in hunting after these isolated pieces of ore. It was generally considered to be a break from the Equator vein, as the mineral was similar to the ore found in that lode, and in close proximity to its supposed course. Others, however, held a different opinion, and began a systematic search for the parent vein by means of drifting through the slidden rock into the solid bed-rock. In one of these the vein has been lately struck and shown to be an entirely new one, that is to say, one until then undiscovered. So far as can be judged by the present openings, many feet of the top of the crevice were broken off by a heavy slide, and scattered on the mountain side below, forming the huge bed of "float," which led up to the ultimate discovery of the lode.



TUNNEL DRILL.—Fig. 2.



BURLEIGH AIR COMPRESSOR.—Fig. 3.

Portland Cement.

DR. ADLOLPH OTT delivered a lecture on March 22, before the Polytechnic Association, on Portland cement and Portland cement stone, which was illustrated with numerous charts, plates, and photographs of works executed in the cement, thus making the subject of more than usual interest. He commenced by saying that nothing had more restricted the application of Portland cement in this country than the circumstance that most parties engaged in the manufacture of stone, or in the laying of floors and sidewalks, endeavor either to conceal what they are using, or try to make the public believe that the strength of the solidified stone is not so much dependent upon the cement, as upon some ingredient (generally harmless) which they use in combination with it. Hence, instead of denominating their products simply cement-stone, or Portland cement-stone—if made of artificial cement—the compound is termed "artificial stone." The public, being well aware of the frequent failures following the attempts to introduce an artificial building stone, which, in most cases, have been gotten up by ignorant parties, now evinces a want of confidence in Portland cement stone, because it is offered as "artificial stone." "I am far from asserting," said the speaker, "that no substitute may be found for good Portland cement; but I hold the opinion, and, I think, with good reason, that all attempts to find such a substitute have thus far failed." He continued by saying that he was also far from maintaining that no further improvements would probably be made in the application of the cement, or in adding ingredients likely to increase its strength and durability, or which may impart some desirable quality or other without proportionally increasing its cost. He was glad to say that such improvements had in fact been made. Should he be able to remove some of the prejudices which are entertained by the majority of builders and architects in the city, with re-

gard to Portland cement, and thus lead them to a more extensive application of the most valuable material, he would feel amply repaid for his labors.

Portland cements are those artificial hydraulic mortars, which are burned so, that vitrification has partially taken place and which, in this condition, contain no free lime, and have a specific gravity above 3. The name originated with JOSEPH ASPDIN, in Leeds, in 1824, who succeeded in producing a cement superior to any made before. The solidified cement, being in appearance and quality equal to that Portland stone, of which the finest edifices of the English metropolis are built, he gave to his product the name of Portland cement.

The cement stone possesses an agreeable bright-gray stone-color; it is capable of being polished, and attains in its best quality a hardness and power of resistance equal to that of the most valued limestones of the oldest formations.

Like the Portland stone of the extensive quarries of Purbeck (England), the solidified Portland cement is of a fine grained texture, and offering no cleavage whatever; it yields evenly to the chisel. But this property can easily be dispensed with altogether, on account of the fact that while soft, it can be adapted to any form.

The specific gravity is 2.676 on the average.

Both the tensile strength and that to resist a crushing force are generally the greater the denser the mortar. The weight required to crush English Portland cement, after it has set for nine months, was found by Mr. GRANT to be 5,973 lbs. per square inch, which is several hundred lbs. more than Patapsco granite, granular limestone, or strong sandstone, are able to bear. In any case, cement stones are capable of bearing a much greater weight th n the best qualities of hard brick.

Fully nineteen-twentieths of all the Portland cement made at the present day is artificial, and the United States abounds in materials which might be used for its manufacture. Clear cement finds but a very limited application; it is mostly employed with an admixture of from two to four volumes of sand, and for beton or concrete (from *concresco*) with an admixture of sand, gravel, or broken stone. The substitution of common lime for a portion of the cement, results always in a sacrifice of strength.

The durability and healthfulness of the new stone were next alluded to, then its merits with regard to its resistance to fire, and an estimate of the cost was given and its uses were spoken of. The latter, the speaker said, were almost innumerable, and there were at present three parties engaged in the fabrication of Portland cement stones in this city. They were Messrs. BANDMAN & JAFFE, the FREAR STONE COMPANY, and the BETON-COIGNET COMPANY. The first named firm was especially engaged in the making of ornamental work, specimens of which were exhibited by the lecturer, who also referred to the fountain in the triangular park, between Broadway and Sixth avenue at 32nd street. This little work was a striking evidence of the resistance to frost and heat of Portland cement, if properly handled. The said firm is now building the front of the new Lyceum Theatre on 14th street and Sixth avenue, of which photographs were also shown.

Treatment of Ores of Native Silver in Chihuahua.

BY H. B. CORNWALL, E. M.

Several districts in Mexico yield considerable quantities of native silver, but nowhere does this class of ore occur so abundantly as at Batopilas in Southern Chihuahua, and the neighboring country. Batopilas especially has become famous for its silver ore, and the object of this article is to describe the mining and reduction of the native silver ores of Batopilas, as exemplified by the actual workings of an American Company, which has now been in eminently successful operation there for several years. In a future article, the treatment of the sulphuretted and other combined ores of silver will be given, with some remarks on mining in Northern Mexico in general. Batopilas is situated in a deep and very narrow valley, or *barranca*, among the western ranges of the Sierra Madre in S. E. Chihuahua, about eight days' journey, by mules, from the nearest port on the Gulf of California. The neighboring mountain ranges show different formations; sometimes the trails lead over trachytic rock, then over granite or dioryte, and again over conglomerate and porphyritic formations. All of these may be met within a six hours' ride from Batopilas. The silver bearing veins, however, are confined to the dioryte, and their universal vein rock or gangue is carbonate of lime, in the white, crystalline form of calcite. Accompanying the native silver, as will be more minutely described, presently, are black sulphuret of silver *(plata negra)*, ruby silver *(rosiclara)*, arsenical iron *(fierro blanco)*, galena *(plomo)* and zinc blende *(copelilla)*; all of which occur, however, in very small quantity. Through the valley runs a river, always supplying a great deal more water than would be necessary to run as many mines as could be worked, and during the rainy season swelling to a torrent. On both sides of the river rise steep mountain ranges, and the silver veins occur in considerable number in both ranges. The particular mine to be described lies on the east side of the river and is worked by a main tunnel, entering the mountain some sixty feet above high-water, and but a few yards from the river bank.

Three of the veins cut by this tunnel, had been worked in old times, and from one of them it is reported that some ten millions of dollars were taken. Probably the report is little if at all exaggerated, for the immense waste heaps and the size of the workings underground show how extensively the vein was worked, and if the present riches of the ore extracted from another vein can be taken as a criterion, certainly an immense amount of silver must have been obtained. The veins have the general trend of the mountain range, although they converge at different points and some of them cross the valley. All are proved by the present tunnel to be true veins, as they are cut from 300 to 600 feet below the surface level of the old workings, and show the same characters below as above. As is always the case where the silver occurs pure, the ore is not uniformly distributed, but occurs in pockets, and sometimes a vein which has yielded a large *bonanza* at one time may be worked for several hundred feet without yielding more than a very moderate amount of silver. Still, although the silver is not continuous throughout, yet in the vein above alluded to, the old workings show a continuous body of ore, varying from three to ten or twelve feet in width, and to a depth (these statements are made from memory, and not from notes) of over two hundred feet. The present tunnel has cut eight large veins, all bearing silver, and by judicious working of these veins, following the indications of rich ore, new deposits may be constantly opened, so that once such a district is developed it may be as successfully worked as if there were but one vein with a continuous body of ore. The Mexicans were not prudent miners. If a large and rich deposit was opened they worked it out as rapidly as possible, not providing by dead work on other veins for the time when their *bonanza* should be exhausted.

It has been said that galena and zinc-blende accompanied the silver. These minerals, taken in connection with a *lively* appearance of the calcite, and the presence of arsenical iron, are the miner's guides. By their occurrence he judges where to look for the silver, and an experienced man can follow them up, until from a merely promising rock he proceeds to the silver itself. The country rock is dioryte, very hard and tough near the mouth of the tunnel, but becoming more tractable further in, and always changing decidedly when near a vein. Occasionally the dioryte, in a somewhat altered state and mixed with calcite, forms the vein rock, as is the case in the largest and richest vein now worked in the tunnel; but invariably wherever pay rock occurs, there the silver is found with the above accompanying minerals.

As regards the method and expense of mining and reducing the ore, the following facts are given, taken from notes furnished the writer, during a twelve months' stay in Batopilas, by the superintendent of the company, who is also the vice-president.

The cost of mining per ton, including all dead work, such as running the front of the tunnel, prospecting, etc., is $33; the actual cost of extracting the silver ore, including necessary drifts, and the work on all the veins yielding silver in paying quantities is $8 per ton. Hauling to the works, on donkeys, about half a mile, sixty-two cents per ton. In another article other details of mining expenses and methods will be given.

The ore is sorted into three classes: 1st class, value $2500 and upwards per ton. 2d class, value $1000—2500. 3d class, all under $1000, averaging perhaps $250.

The third class ore is dumped at the stamps, the better ore is kept in a store room and weighed out. All the ore is crushed in a battery of three small stamps, weighing about 300 lbs. each, with a fall of nine inches, and a capacity of eight tons per twenty-four hours. The ore falls through a screen with ⅛ inch slits, and is then charged in the arastra. The lumps of silver are separated by the screen, cleaned by hand, and, with the larger lumps of pure silver from the mine, refined with the retort silver. The stamps are run by a horizontal water wheel, which will be described under the arastra. This latter apparatus it is unnecessary to describe to the readers of this Journal. Suffice it to say that it is a large Mexican arastra, nine feet in diameter, with two stone mullers or runners, weighing 600 to 800 lbs. each. The wheel that runs it is, however, peculiar. The arastra is built on the top of a pile of masonry in a deep pit. In the centre of the arastra rises a shaft, revolving on a pivot which rests in a plate raised a little above the bed of the arastra, and from this shaft horizontal arms project beyond the rim of the arastra. From these arms descend rods which support a horizontal wheel that thus revolves around the arastra a few inches above the bottom of the pit. In the periphery of this wheel, at intervals of six inches, are inserted rectangular floats, slightly concave, and set up edgewise, as if to receive the water from a tangential, horizontal shute. These floats are called *cucharas* (spoons), and hence these arastras are called *arastras de cuchara* as distinguished from the *arastra de mula*. The water acts on this wheel solely by its momentum, acquired while descending very rapidly through a tapering shute, having a fall of eight feet with a length of twelve to fifteen feet. It is very evident that there is a great loss of power here, but as the works are supplied with a superabundance of water by a ditch, and the three arastras are capable of reducing all the ore required, this makes little difference. These arastras are universally employed in Mexico when water power is at hand. Such a wheel, with a diameter of twenty feet, will carry the two runners of the arastra as fast as four stout mules, which could not work more than eight hours per day, and it runs the battery of stamps as above stated.

[TO BE CONTINUED.]

Boiler Explosions.

TO THE EDITOR

SIR—Having written some articles on Boiler explosions, soon after the great one on board the Westfield, last summer, in one of which, (inserted in your Journal, of the 26th September last) I suggested a plan for limiting the pressure to something like a reasonable, and safe one on board passenger boats, and at the same time a simple plan for detecting scarcety of water in the boiler, without any possibility of failure, provided there was steam on at the time. I had then resolved to be forever done with the subject; it appearing to be only a waste of time, labor, and patience. The practice in these days of

carrying a pressure on our boats so high as to be exceedingly dangerous, has become so confirmed, that any attempt at reform is almost, if not entirely, hopeless—but on taking up a paper a day or two since, and reading an account of the terrific explosion in a candle factory in Cincinnati of a boiler *eight years old*, in which the carrying of a pressure of 250 pounds to the inch was the regular thing, although 300 had formerly been their mark, and then closing with the usual sage remarks: "the cause of the explosion is unknown.—An investigation will probably be made"—aroused a feeling in my mind very nearly akin to indignation; and I have found it impossible to keep entirely quiet.

The cause *unknown* indeed!! the mystery as usual, unfathomable, with the above facts as to the pressure used on the boiler, admitted!

As well might the cause of the bursting of Commodore STOCKTON'S gun, the "Peacemaker," on board the Princeton some years ago be questioned; when it is well known that it was fired again, and again, with hollow shot, and charges of powder of fifty pounds or thereabouts, sufficiently large to put the shot out of shape, wedge them fast in the gun, and then send them out in pieces.

There does not seem to me to be any great mystery to be accounted for in either of these cases, but about the same in one as the other, though I am not aware that any one ever doubted that powder caused the gun to explode—nor do I suppose there is any more occasion to doubt that a pressure of steam greater than the boilers were capable of sustaining, was the cause of bursting them.

Judging from the usual practice in such cases, I infer that the investigation referred to, will be conducted by a set of men about as well qualified, by *ignorance*, for their duty, as the set of jurors in your City of New York, now trying some of the members of the broken Tammany ring, are for theirs—though there will not be the same pains taken in their selection to get men of a particular stamp, as is the rule at the present day, in making up a jury for trying culprits under criminal indictment.

But I have wandered from the main subject I undertook to discuss, and will now return to it, remarking just here that if the sufferers by the Westfield disaster or their representatives go on getting verdicts in their favor of five thousand dollars each, the proprietors of that craft will, ere long, discover the propriety of taking measures for having the mystery of boiler explosions solved, and so be enabled to take such measures as would guard against their too frequent occurrence in the future.

In the Cincinnati case it must be admitted, there is some necessity, and of course some justification for the use of high (or to use the Western phrase, *strong steam*), as it was said to be used for tanking out lard for the purpose of making candles; but such a manufactory should be placed in the same category with powder mills and erected in some out of the way place as they are, and not in a city.

Let me now say, though I made the assertion on a former occasion, that these serious and destructive accidents from steam do not occur except when steam of high elasticity is used, and we cannot, I think, go on in the direction we have for the last thirty or forty years in this country, increasing the risk of steamboat travelling on what are, by courtesy, called low pressure boats, without being soon compelled to appeal to Congress for the passage of a general law restricting and limiting steamboat companies to some pressure adapted to the condition and wants of civilized and intelligent people.

Some of our theoretical engineers and lecturers, I have noticed lately, are recommending to their audiences, or to those of inventive genius among them, to give their attention to the task of inventing some mode of using higher steam, with *entire safety*. This is all very excellent advice, and doubtless should be followed, if there were any rational prospect of the desideratum being attained; but, before this can be done, some material of unlimited strength, and not subject to wear, or deterioration from use, must be discovered, out of which to construct boilers, and I don't see how this is to be practically attained—though it may be quite easily, at any time, in the brain of some of our visionaries.

Mr. WATT, we know, in his time was content to use steam at a pressure of only four or five pounds to the inch, and supplied his boilers on the "feed-head" plan, a plan not used, and scarcely known, among us. In it the supply was regulated by an automatic contrivance, which would not supply at all, as it was generally constructed, under a pressure greater than that alluded to.

If for any purpose great power was required, he used a cylinder of sufficient capacity, and the steam acting on a piston of large area, the work was done, safely and economically.

In those days serious disasters were infrequent, but now they are of daily occurrence, though great progress has been made in later times, both as regards economy of fuel and the strength and efficiency of boilers. In one case I know of, in the olden time, a boiler collapsed from atmospheric pressure in consequence of the engine continuing on at work, and exhausting the steam from the boilers, until the internal became less than the external, or atmospheric pressure; but this only injured the boiler, without endangering life.

In those days boilers were not generally made in such shape, or of such strength as to be capable of bearing great strains of any kind, though the engine, boilers, and all their attachments must have been very tight and in perfect order, or such a phenomenon could not have occurred.

Some claims have recently been put forward on account of the invention of the high pressure engine. Now, I can only compare the high pressure plan, as contrasted with the low pressure, to the "play of Hamlet with Hamlet left out;" for though the high pressure embraces an additional dangerous element, the beautiful philosophical apparatus of the other is left out. There are situations where the high pressure engine is the right thing in the right place; but that place is not afloat, or, in other words, on board a boat.

Some of our English Cousins (though but a very small portion of them, I conjecture,) have, it would appear, fallen in love with high steam, and are commencing to use it in a condensing engine, known as the compound or binary, or what was known in earlier times as WOLF'S plan, since it was first introduced by an engineer of that name, at Leeds, Yorkshire, England.

This plan, according to a newspaper account I met with lately, has been adopted on one or more of the steamers of an English line running to New York, and it is said in the account referred to that a pressure of sixty pounds to the inch is used on the small cylinder, which would of course be expanded and lessened as it passed to the larger one. As the pressure on the boilers must be at least as great as in the small cylinder, it follows that some hazard must be incurred, and should an explosion take place in mid-ocean, for instance, the remark, "no cause is known" for the accident, would for once be literally true, as probably no one would be left to tell the tale.

The merits of this complicated plan, if it has any, have been slow in being discovered, for the first and only example of it I ever saw was in 1823, just fifty years ago. If I wanted now to make a voyage to Europe, though I am pretty well advanced in life, and the remainder is, perhaps, not worth much, I would not go in one of these steamers, or recommend others to do so; but, if necessary, should prefer to take twenty-four hours longer time for the passage, in a safe vessel, though I do not believe the difference should be one half of that time.

Steam has certainly done some good service in the world, and may yet do a great deal more with very little risk of harm, if managed with proper skill and prudence.

AN OLD ENGINEER.

MARCH 28, 1872.

Polytechnic Association of the American Institute.

Meeting held March 18th, 1872, President TILLMAN in the chair.

THE President opened the meeting by reading items of scientific news.

ARTIFICIAL LEATHER.

Dr. P. H. VAN DER WEYDE exhibited a specimen of leather made from waste leather scraps, which are treated in a way similar to the manner in which glue is extracted, but not going far enough to change the leather in gelatine. A small quantity of caustic soda and lime is placed in a steam boiler, with the scraps, and they are heated to about a pressure of an atmosphere and a half. This makes a pulp, which is treated like paper, made into sheets or into any required form. It cannot stand wear and tear like common leather, but for insoles and for many other purposes is just as good.

The PRESIDENT remarked that this would be inferior to leather, where the pores are useful to carry off the perspiration; and should not be used where this is important.

Dr. RICHARDS—There is about the same relation between this leather and the real skin leather, as there is between paper and linen cloth. Paper is used extensively for insoles, and this is better and cheaper to the wearer. It would make excellent packing.

Dr. WEATHERBY suggested its use as a substitute for papier-maché.

Dr. J. V. C. SMITH said that it would certainly be better even for the soles of boots and shoes than birch bark, which is sometimes put into brogans intended for the Southern market.

Dr. RICHARDS stated that in manufacturing towns, leather scraps are sometimes used for fuel.

Dr. VAN DER WEYDE stated that nitrogen compounds are made from them, as prussian blue; and that they are also used for manure.

Mr. BALL—They make a valuable charcoal.

RELIEF OF FOURTH AVENUE.

Mr. J. V. HENRY NOTT exhibited a model of a proposed iron avenue to be erected over the Fourth avenue, to be approached by inclined planes of iron from the side streets. The expense would be more than repaid by the increased value of the adjoining property. The level of the new avenue would be that of Park avenue. It would cost about six millions, for the whole length of four miles. The buildings which might be erected upon the new avenue would yield a revenue paying a fair percentage upon the cost.

Dr. RICHARDS considered it a great mistake to place the new depot at Forty-third street. It should have been placed on the North River, affording convenient communication with the railroads terminating in Jersey City.

Mr. NOTT—As soon as this avenue is finished, we have more than half the distance finished for a fast railroad. It would only be necessary to complete the track down to the Battery.

The PRESIDENT stated that when the subject of rapid transit was discussed in the Polytechnic Association, two years ago, the plan most approved was the elevated railway, passing over the cross streets and between the blocks. The objection to the railway over the streets is the danger of frightening horses.

Dr. VAN DER WEYDE said the horses were already becoming accustomed to it. He considered the best project to be the Barlow plan.

Dr. T. D. STETSON spoke on the subject of drain-pipe, after which the meeting adjourned.

THE COAL TRADE.

Anthracite Coals.

NEW YORK, March 29, 1872.

The demand for coal continues quite good, but the prices are not any higher than last month, with the exception of Lehigh Coals, which have advanced somewhat. The following are the rates fixed by the Lehigh Coal Exchange on March 27th for April shipments at Elizabethport, Port Johnson and Hoboken :

Lump	$5 00
Broken	4 25
Egg	4 25
Stove	4 50
Chestnut	4 00

The result of the Auction sale was, we believe, surprising to almost all engaged in the coal trade. Everybody had been expecting some advance, but as will be seen from the official figures which we give below, the change is scarcely perceptible, the general average of the whole being only half a cent per ton different.

DELAWARE, LACKAWANNA & WESTERN R. R. CO.

General Office, 26 Exchange Place, New York.

100th Auction sale, March 27, 1872, 125,000 tons.

Lump	$3 47½	to	$3 50	Average.....	$3 47½
Steamer....	3 50	to	3 55	"	3 53½
Grate.....	3 57½	to	3 62½	"	3 60½
Egg.....	3 60	to	3 65	"	3 63½
Stove.....	4 05	to	4 15	"	4 09½
Chestnut...	3 55	to	3 60	"	3 57½

Anthracite Coal Trade for 1871 and 1872.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending Mar. 23, 1872, compared with the week ending Mar. 25, 1871.

COMPANIES.	1871. WEEK.	1871. TOTAL.	1872. WEEK.	1872. TOTAL.
*Phila & Reading R.R†	26,675	697,604	72.105	946,646
Schuylkill Canal	....	....	....	....
Lehigh Valley R. R.	10,302	384,018	51.598	827,676
Lehigh & Sus. R. R.	1,792	68,920	23,940	299,730
Lehigh Canal	....	....	....	....
Scranton North	....	3,521	6,718	142.748
" South	....	137	33,676	439,717
Penn. Coal Co., rail	204	3,445	15,726	206,729
" " " canal	....	....	....	....
Del. & Hud. Canal Co.	....	....	....	....
" " East	1,069	49,402	11,932	131,613
" " West	....	12,720	6.740	86,664
" " South	....	....	4.311	74.062
Shamokin	11,424	99,946	6,733	82,850
Trevorton	....	....	....	....
Lykens Valley Coal Co.	891	10,937	..	2,580
Wyoming South	....	....	....	....
Wyoming North	....	....	....	....
P. N. Y. C. & R. R. Co.	462	34,793	10,404	181,854
Williamstown Col'y	....	17 847	....	
Big Lick Col	....	15,342	....	10,591
Total	52,819	1,398 631	213,883	3,403,460
1870	....	....	52,819	1,398,631
Decrease				
Increase			191,064	2,004,829

* These figures are for the week and fiscal period commencing Nov. 30

† Less coal transported for Co's use and Bituminous coal.

Bituminous Coal Trade, 1871 and 1872.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending March 23, 1872, compared with week ending March 25, 1871.

COMPANIES.	1871. Week.	1871. Year.	1872. Week.	1872. Year.
C. & O. Canal	14,241	33,969	8,431	8,845
B. & O. R. R.	30,746	189,583	22,743	222,819
H. & B. T. R. R.	8,074	65,279	7,543	67,254
*Harrisburg & D.	13,164	102,974	10,064	148,018
*L. V. R. R.	....	12,734	556	8,970
P. & N.Y.C. & R. Co.	6,512	67,063	6,630	88,340
Cumberl'd Branch Canal	6,595	10,699	3,062	3,062
" " Railroad	1,638	16,657	291	291
Total	79,940	508,948	59,320	547.599
	59,320			508.948
Decrease	20,620			
Increase				38,651

Lehigh Coal and Navigation Company.

Report of Coal transported over the Lehigh Canal and L. & S., Div. of Central Railroad of New Jersey for the week ending March 23, 1872, and for the year 1872.

	WEEK.	YEAR.
Forwarded East of Mauch Chunk by Rail	23 940	299,730
Delivered at and above do.,	942	14,651
Forwarded East of do., by Canal	....	....
	24,882	314,381
Corresponding period last year—		
Forwarded East of Mauch Chunk by Rail	1,791	68,919
Delivered at and above do.,	241	9,672
Forwarded East of do., by Canal	....	....
	2,031	78.592
Increase on Railroad	22,848	232,789
Decrease " "		
Increase on Canal		
Decrease " "		
Of the above there was transported on account of—		
Lehigh Coal Nav. Co	9,248	80,877
Wilkesbarre Coal & Iron Co	10,441	171,182
	19,693	252,059
Corresponding period last year—		
Lehigh Coal Nav. Co	86	18,941
Wilkesbarre Coal & Iron Co	1,677	40,550
	1,764	59,491
Increase	17,929	192,568
Decrease		

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, March 23, 1872.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	25.651	11
" Port Carbon	5,055	01
" Pottsville	763	06
" Schuylkill Haven	13,715	17
" Pine Grove	4,308	11
" Tamaqua	6,273	07
" Harrisburg		
" Dauphin	156	07
Total	55,923	19

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	892	09
" Mill Creek "	1,466	03
" Schuylkill Valley Scales	120	06
" Mt. Carbon "		
" Cressona "	1,234	00
" Pine Grove "		
" Tamaqua "	177	13
Total	3,890	11

SHIPPED WESTWARD VIA NORTHERN CENTRAL RAILROAD.

Passing Locust Gap	104	14
" Shamokin	4,883	05
" Herndon	.....	
Total	4,987	19

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	1,482	07
" Lebanon & Pine Grove Branch	832	01
Total	2,314	08

CONSUMED ON LATERALS.

From Frackville Scales	657	17
" Mill Creek "	328	02
" Schuylkill Valley Scales	721	19
" Mt. Carbon "	696	18
" Cressona "	418	09
" Pine Grove "	304	14
" Tamaqua "	517	15
Total	3,676	13

LEHIGH AND WYOMING COAL.

Received via Allentown, E. Penn'a Br.	55	18
" " Alburtis, " "		
" " Oreland, G. & N. Br.	894	16
" " Connecting R. R.	.....	
" " Willow Street R. R.	360	18
Tota	1,311	12

BITUMINOUS.

From Harrisburg	10,799	08
" Connecting R. R., G. & N. Br.		
" Junction R. R.	264	15
Total	11,064	04

COAL FOR COMPANY'S USE.

Anthracite	4,690	02
Bituminous	223	15
Total.	4,913	17

RECAPITULATION

	Total for Week.	Corres-p'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val Branch	55,923 19	14,489 09	i 41.434 10
For Shipment by Canal	3,890 11	935 14	i 2,954 17
Shipped Westward via Northern Central R. R.	4,987 19	8,397 05	d 3,409 06
Shipped West or South from Pine Grove	2,314 08	1,333 07	i 981 01
Consumed on Laterals	3,676 13	1,519 02	i 2,157 11
Lehigh and Wyoming Coal	1,311 12		i 1,311 12
Total Anthracite paying freig't	72,105 02	26.674 17	i 45,430 05
Bituminous	11,064 03	13,163 17	d 2,099 14
Total of all kinds paying freig't	83,269 05	39,838 14	i 43,330 11
Coal for Company's use	4,913 17	5 592 04	d 678 07
Total Tonnage for Week	88,083 02	45,430 18	i 42.652 04
Previously this year	10703.6903	813,634 14	i 256,734 09
Total to date	1158452 5	859,065 12	i 299,386 13

SHIPPED BY CANAL.

From Schuylkill Haven			
" Port Clinton			
Total Tonnage per Week			
Previously this year			
Total to date	13,355 16	36,225 17	d 22,870 10

Delaware and Hudson Canal Company.

The following is a statement of Coal Transported by the Delaware and Hudson Canal Co. for the week ending March 23, 1872.

	FOR THE WEEK.	FOR THE SEASON.
By Delaware and Hudson Canal,	.....	
By Railroad, East	11,932	131,613
" " West	6,740	86,664
" " South	4,311	74,062
Total Tons	22,983	292,339
For the same period last year.		

	FOR THE WEEK	FOR THE SEASON.
By Delaware and Hudson Canal,		
By Railroad, East	.....	49,402
" " West	1,096	12,720
" " South	.....	.....
Total Tons	1,069	62,122
Increase	230,217	

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending March 23, 1872.

	1872. WEEK.	1872. YEAR.	1871. WEEK.	1871. YEAR.
By Railway	15,726 11	206,728 13	203 19	3,445 10
" Canal	.....	.....	.....	.....
Total	15,725 11	206,728 13	203 19	3,445 10
Increase 1872	203,283 03			

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending March 23, 1872.

	Week. Tons.	Cwt.	Total. Tons.	Cwt.
Anthracite received :				
From Lehigh Valley R. R.	6364	03	85,337	12
" Lack. & B. R.R.	1478	12	21,534	09
" Pleasant Valley R. R.	764	06	28,604	15
" Snl. & Erie R. R.	1206	15	16,377	07
Total	10,403	16	151 754	03
Distributed :				
To Lehigh Valley R. R.			18,115	15
To Lack. & B. R. R.	74	04	959	18
To S. Central R. R.	2566	15	25,154	03
To Ithaca & A. R. R.	2804	06	34,857	04
To Erie R. W. Pockets for shipm't.	3187	10	40,348	19
To individuals on line of road	392	04	10,082	00
To points at & above Carbon for use of Co	348	11	7,547	07
To points between Waverley and Elmira	1030	06	14,786	17
Total	10,403	16	151,854	03
Bituminous :				
Received from Barclay R. R.				
Shipped North from Towanda	6604	04	87,481	14
Shipped South from Towanda	26	02	767	07
Northern Central R. R.			91	01
Total	6630	06	88,340	02
Distributed :				
To Erie R. R.	6145	04	76,493	09
To So. Central R. R.	459	00	10,836	10
To Ithaca & A. R. R.	.....		21	15
To Lehigh Valley R. R.	26	02	708	16
To individuals on line of R R.	.....		253	11
Total	6630	06	88,340	02

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending March 23, 1872, with totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	8,488 12	150,391 09
" Hazleton	37,353 09	644,347 11
" Upper Lehigh	94 19	945 06
" Beaver Meadow	10,401 01	196,872 02
" Mahanoy	4,8.7 12	62,863 18
" Mauch Chu	107 17	1,1o0 16
Total	60.976 10	957,087 02
Same time last year	1.136 10	438, 13 06
Increase	49,840 00	518,973 16
Decrease		
Forwarded East from Mauch Chunk by rail	51,597 11	827,675 13
Same time last year	10,3.1 12	384.018 01
Increase	41,295 19	443,657 12
Decrease		

DISTRIBUTED AS FOLLOWS.

Forwarded East from Mauch Chunk by rail	50,752 10	811,127 1
do East for use L. V. R R	845 01	16,547 1
Delivered at and above Mauch Chunk for use of L. V. R.R.	697 03	18,468 1 9
To P. & N. Y. R. R	6,9.4 03	85,3.7 1 2
To N. C. R. R., at Mount Carmel		73 06
To D. H & W. R. R.	770 13	6,393 07
To L. & S. R. R. at Packerton for rail	281 14	4,963 06
Delivered at M'h Chunk	16 00	713 17
Delivered on line of road above Mauch Chunk	130 10	7,413 12
To L. & S. R. R., at Penn Hav., for railroad	59 05	3,950 07
Do for canal		864 07
To Lehigh Canal Mauch Chunk		99 07
To Catawisa Railroad	469 02	1,130 07
Total	60,976 10	957,087 02

Report of Coal Transported over Central R.R. of N. J. (Lehigh and Susq. Div.)

Week ending March 23—Compared with same time last year.

WHERE SHIPPED FROM	WEEK 1872, tons ct	WEEK 187 . tons ct.	YEAR 1872 tons cwt.	YEAR 1871, tons.cwt.
Wyoming Region	13517 06	1919 04	233152 07	59152 13
Upper Lehigh Region	3471 00		41865 13	4614 06
Beaver Meadow Region				
Hazleton Region	322 09	73 00	3721 17	916 04
Mahanoy Region				
Freeckow Region	1219 18		8745 08	1043 03
Mauca Chunk Region	9838 01	86 15	74750 04	17701 13
Totals	27490 14	2078 19	362215 09	83730 19
Increase	25417 15		281484 10	
Decrease				
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	23940 04	1791 13	299730 02	68919 15
Forwarded East of Mch Chunk by Canal				
Delivered at and above Mauch Chunk	942 02	241 19	14651 11	9672 11
L. V. R. R at Packer'n	389 16	45 07	3927 15	2138 13
Delivered to L. & B. R. at Plymouth Bridge	2224 12		43306 01	
Totals				
Of the above there was transported on acc'nt of L. C. & N. Co	9248 14	86 16	80877 03	18341 02
W.-B. C. & I. Co.	10444 12	1677 05	171182 15	40050 12
Totals	19693 06	1764 00	252059 18	59491 12
Increase	17929 06		192568 06	
Decrease				

Huntington and Broad Top R. R. Co.

For week ending March 23, 1872	7,543 tons.
Same time last year	8,074 "
Increase	
Decrease	531 "
Total amount shipped to date	67,254 "
Same time last year	65,279 "
Increase	1,975 "
Decrease	

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna and Western R. R., for week ending March 23, 1872:

	Week. Tons. Cwt.	Year. Tons. Cwt.
Shipped North	6,717 11	142,748 00
Shipped South	33,676 08	349,716 19
Total	40,393 19	582,464 18
For the corresponding time last year:		
Shipped North		
Shipped South		12
Total	2,719 18	3,657
Increase	37,674 01	578,807 06
Decrease		

Shamokin Coal Trade.

For week ending March 23, 1872	6,732 18
Same time last year	11,423 16
Increase	
Decrease	4,690 18
Total amount shipped to date	82,859 09
Same time last year	99,945 18
Increase	
Decrease	17,095 09

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, March 23, 1872.

	WEEK.	SEASON.
North	35,324 07	537,883 19
South	4,310 19	74,061 13
Total 1872	39,635 06	611,945 12
Corresponding time in 1871:		
North	Suspension.	
South	"	
Total		
Increase North		
Decrease North		
Increase South		
Decrease South		
Total decrease 1872		
Total increase 1872	39,635 06	611,945 12

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday March 23, and during the year 1872, compared with the corresponding period of 1871.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To B.&O.R.R. Co Tons Cwt.	Total. Tons. Cwt.
1872	8,451 07	22,743 07	31,174 14
1871	14,240 18	30,745 11	44,986 09
Increase			
Decrease	5,789 11	8,002 04	13,811 15

YEAR.

1872	8,845 03	222,858 17	231,744 00
1871	33,969 05	189,582 17	223,552 02
Increase		33,969 06	8,111 18
Decrease	25,124 03		

Cumberland Branch R. R.

WEEK.

	To C.& O. Canal Tons. Cwt.	To B &O. R.R. C. Tons. Cwt.	Total. Tons Cwt.
1872	3062 05	290 10	3,352 15
1871	5395 00	1,608 03	7,203 03
Increase			
Decrease	2332 15	1,317 13	3,850 08

YEAR.

1872	3,062 05	290 10	3,352 18
1871	10 693 15	16,660 13	27,355 05
Increase			
Decrease	7,636 10	16,366 03	24,002 13

Prices of Coal by the Cargo.

[CORRECTED WEEKLY.]

Company Coals.

March, 1872.

	L.	Str.	Grs.	Egg.	Stv.	Chest
Scranton at E. Port	3 59	3 77	3 63	4 02	4 10	3 31
*Pittston at Weehawken	4 09	4 16	4 15	4 25	4 30	4 00
*Lackawanx at Weehawken	3 75	3 75	3 85	3 85	4 25	3 75
Wilk'b're at Hoboken	3 75	3 75	3 85	3 85	4 25	3 75
Old Co. Lehigh at Pt John'n	4 75	—	4 00	4 00	4 50	4 00
Lehigh at Eliz. Port	4 75	—	4 00	4 00	4 50	4 00

For freights to different points see "Freights."
* To contractors only.

Bituminous Coals (Cumberland).

Georgetown, F.o.b	$4.25
Baltimore "	4.70
New York "	6.75

Prices of Gas Coals.

March, 1872.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr., 41-43 Pine st., N. Y.

Duty, $1 25, gold	Coarse	Slack.
Block House	$1 60 @	1 75
Gowrie	1 60 @	1 75

Corrected by Bird, Perkins & Job, 86 South street.

	Coarse.	Culm of Coal.
Pictou	$2 25 @	1 25
Sydney	2 25 @	80
Lingan	1 60 @	80
Little Glace Bay	1 60 @	1 00
Caledonia	1 60 @	80

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty $1 25 per ton, gold, on the coarse coal. 25 per cent. ad valorem on the Culm of Coal.

AMERICAN.

	Currency.
Westmoreland	$7 00 @ —
Fairmount Gas Coal Co. of N. Y.	7 00 @ —
Despard Coal Co	7 00 @ —
Penn	7 00 @ —
Newburg Orrel Gas	— — @ —
West Fairmount Gas Coal	7 00 @ —
AT PHILADELPHIA.	
Powelton	$6 75

TO NEW YORK.

Provincial.	
Sidney	$3 25
Lingan	3 25
Cow Bay	3 37½
Port Caledonia	3 37½
Little Glace Bay	3 25

Prices of Foreign Coals.

March, 1872.
Duty $1 25 per ton.

Corrected weekly by PARMELE BROS., No 32 Pine street, N. Y.

Liverpool Gas Caking	$ 8 00 @ — —
" " Cannel	12 00 @ 13 00
" House "	18 00 @ 20 00
" Orrel	14 00 @ 16 00

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened	$16 00 @ 17 50
"Cannel, "	20 00 @ 25 00

Per ton 2,000 lbs. delivered.

Freights.—March, 1872.

TO EASTERN PORTS.	Cumberland. From Georgetown.	Cumberland. From Baltimore.	Anthracite. From Philadel'a.	Anthracite. From Eliz. Port, Port Johnson, and Hoboken.	Anthracite. From Newbury...	Anthracite. From Rondout...
Amesbury						
Bangor						
Bath						
Boston		3 25		2 75		
Bridgeport		2 75		1 00		
Bristol						
Derby						
Dighton		2 75				
East Cambridge						
Fall River		2 75				
Hackensack						
Hartford						
Hartford		2 00		50		
Jersey City						
Middletown						
Mystic						
New Bedford		3 00				
Newburyport		3 50				
New Haven		2 75		1 00		
New London		2 75	3 50	1 40		
Newport				1 75		
New York	2 25	2 30		50		
Norwalk				1 00		
Norwich				1 50		
Pawtucket						
Portland		3 35		2 00		
Portsmouth, N.H		3 75				
Providence		2 75		1 75		
Rockport						
Saco						
Sag Harbor		3 75				
Salem		3 50		2 75		
Stamford						
Stonington				1 50		
Taunton						
Warren						
Washington						
TO RIVER PORTS.						
Albany						
Catskill						
Cocksackie						
Coeyman's						
Cold Spring						
Fishkill						
Haverstraw						
Hudson						
New York						
Nyack						
Poughkeepsie						
Rhinebeck						
Rondout				70		
Saugerties						
Sing Sing						
Stuyvesant						
Tarrytown						
Troy						
West Point						
Yonkers						

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven for consumption	$1 25
For reshipment	

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 64
C. R. R., N. J., Phillipsburgh to Elizabethport	0 95
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$1 94

MAUCH CHUNK TO PORT JOHNSON.

L. V. R.R., or L. & S. R.R. from M. C. to Phillipsb'g	$0 64
C. R. R., of N. J., Philipsburgh to Pt. Johnson	0 95
Shipping expenses	25
Wharfage	10
Total	$1 94

TO HOBOKEN.

L. V. R. R., Mauch Chunk to Phillipsburgh	64
Morris & Essex R. R. Phillipsburgh to Hoboken	0 95
Shipping expenses	25
Wharfage	10
Total	$1 94

TO SOUTH AMBOY.

L. V. R. R.	72
L. & D. R. R.	
Cam. & Am R. R.	91
Shipping Expenses	35
Total	$1 08

PENN HAVEN TO ELIZABETHPORT.

L. V. R.R. Penn Haven to Phillipsburgh	0 75
C. RR. of N. J. Philipsburgh to Elizabethport	0 95
Shipping expenses	25
Wharfage	10
Total	$ 2 05

METALS.

NEW YORK, March 27, 1872.

IRON.—Duty: Bars, 1 to 1½ cents ₱ lb; Railroad, 70 cents ₱ 100 lbs.; Boiler and Plate, 1½ cents ₱ lb; Sheet, Band, Hoop, and Scroll, 1¾ to 1¾ cents ₱ lb; Pig, $7 ₱ ton; Polished Sheet, 3 cts. ₱ lb; Galvanized 2¼; Scrap Cast, $6; Scrap Wrought, $8 per ton

	Store Prices.
Pig, Scotch No. 1, ₱ ton	50 00@54 00
Pig, American, No. 1	50 00@52 —
Pig, American, No. 2	49 00@50 —
Pig, American, Forge	47 00@48 —
Bar Refined, English and American	95 00@100 00
Bar Swedes, assorted sizes (gold)	85 00@100 00

	Store Prices, Cash.
Bar, Swedes	120 00@130 00
Bar, Refined, ⅜ to 2 in. rd. & sq. 1 to 6 in. x ⅜ to 1 in.	105 00@— —
Bar, Refined, 1⅛ to 6 by ⅛ & 5:16 & 2½ to 2¾ rnd. sq.	110 00@— —
Bar, Refined, 1 & 1⅛ by ¼ & 5:16	112 50@— —
Large Rounds	117 50@122 50
Scroll	117 50@147 50
Ovals and half-round	120 00@130 00
Band	— —@117 50
Horse Shoe	115 00@125 50
Rods, ⅜ to 3-16 inch	110 00@150 00
Hoop	130 00@172 50
Nailrod	7½@— —
Sheet, Russia, as to assortment (gold)	17¾@ 18 —
Sheet, Singles, D. and T. Common	—6 @— 7
Sheet, D. an I T. Charcoal	—7½@— 8
Sheet, Galv'd, Nos. 10 to 27	10@13c lb.
" Nos. 28, and 29	15@19c lb.
Rails, English (gold), ₱ ton	65@70 00
Rails, American, at Works in Pa	76@80 00

COPPER.—Duty: Pig, Bar, and Ingot, 5; old Copper 4 cents ₱ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ₱ lb	— @— 28
Copper Bolts	— @— 40
Copper Braziers, 16oz. and over	— @— 40
Copper Nails	— @— 45
Copper, Old Sheathing, &c. mixed lots	— @— —
Copper, Old, for chemical purposes, 14@16 oz.	— @— —
Copper, American Ingot	30½@— 31
Yellow Metal, New Sheathing & Bronze	— @— 26
Yellow Metal Bolts	28 @— —
Yellow Metal Nails	— @— 28

LEAD.—Duty: Pig, $2 ₱ 100 lbs.; old Lead, 1¼ cents ₱ lb; Pipe and Sheet, 2¼ cents ₱ lb.

Galena, ₱ 100 lbs	$— @— —
Spanish (gold)	5 90 @6 00
German, do.	5 90 @6 00
English do.	5 95 @6 70
Bar (net)	9 25 @— —
Pipe (net)	— — @10 00
Sheet	— — @10 00

Colwell, Shaw & Willard Tin-Lined Lead Pipe 15 cts. ₱ lb.

STEEL.—Duty: Bars and ingots, valued at 7 cents ₱ lb or under, 2¼ cents; over 7 cents and not above 11, 3 cents ₱ lb; over 11 cents, 3½ cents ₱ lb, and 10 ₱ cent ad val. Store prices.

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American, Cast, Tool	do.	— 15 @— 16
American, Spring,	do.	— 9 @— 11
American Machinery	do.	— 9 @— 10
American German,	do.	— 9 @— 11

TIN.—Duty: Pig, Bars, and Blocks, 15 ₱ cent. ad val.: Plate and Sheets and Terne Plates, 25 ₱ cent.; Roofing 25. ad val.

	Gold ₱ lb.
Banca	— @46
Straits	40 @—
English	39½@39¾

PLATES.

Fair to Good Brands.	Gold.	Currency.
I. C. Charcoal, ₱ box	$12 50 @13 00	$14 00 @14 50
I. C. Coke	10 75 @11 00	12 25 @12 50
Coke Terne	9 25 @ 9 87½	10 50 @11 25
Charcoal Terne	10 25 @11 00	12 00 @12 50

SPELTER—Duty: In Pigs, Bars & Plates, $1.50 p. 100 lb

Plates, Foreign (gold) p. 100 lb.	7 25@7 50
Plates, Domestic p lb.	— 7 @— 11

ZINC—Duty: Pig or Block, $1.50 per 100 lb.; Sheet 2½c per lb

Sheet per lb.	— 10 @— 11

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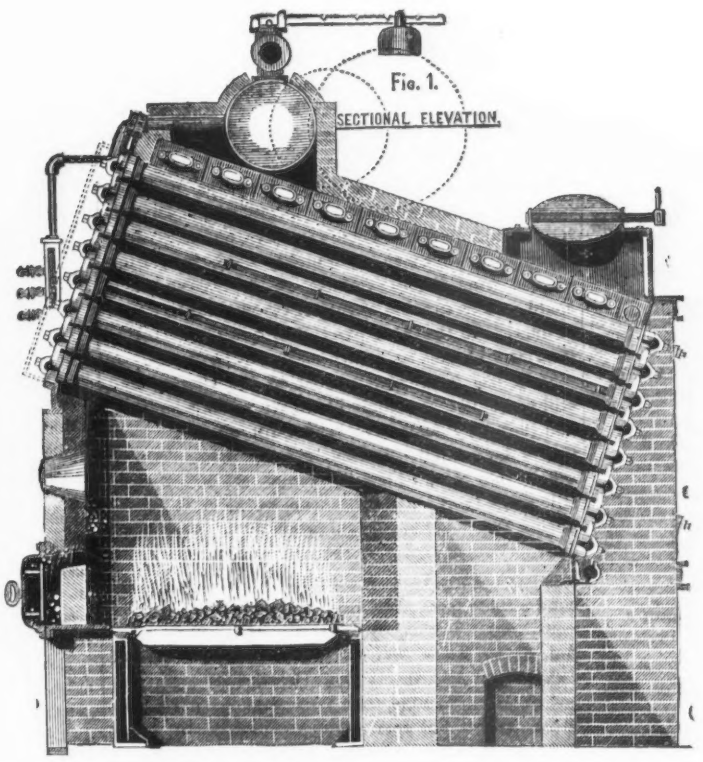
Such a boiler we now offer to the public, and shall constantly keep on hand all parts, ready for shipment, by which new Boilers may be furnished, or any of our Boilers in use may be enlarged, or any of their parts renewed at short notice and small expense.

The distinctive claims presented by this Boiler are: Safety from Destructive Explosion, the Utmost Durability, the Highest Economy of Fuel, Reasonable Price.

The working portion is composed entirely of Wrought-Iron Boiler Tubes, which are tested to a Pressure of 500 pounds per square inch.;

Fig. 1.

SECTIONAL ELEVATION.



The largest Boiler is equal in strength to the smallest, as all are composed of a greater or less number of the same parts, uniform in size and strength. This peculiarity of construction secures very light weight and small size of parts; great portability; the largest Boiler can be carried into the most difficult places, through doors and down common stairways, where necessary.

Very cheap freights, owing to very light total weight and low freight classification.

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Fig. 3.

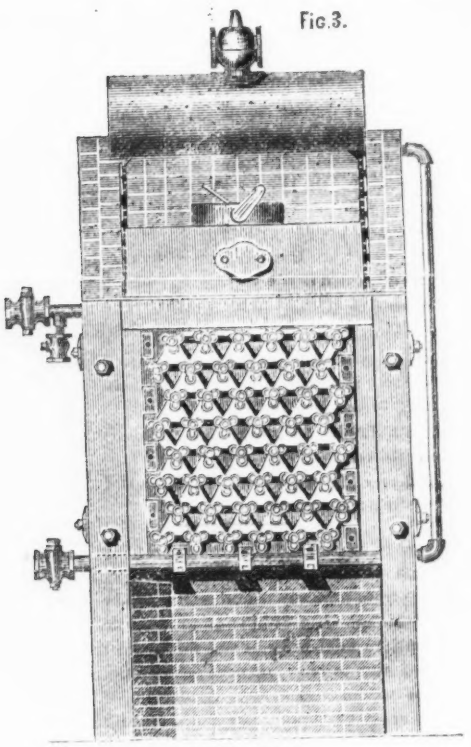

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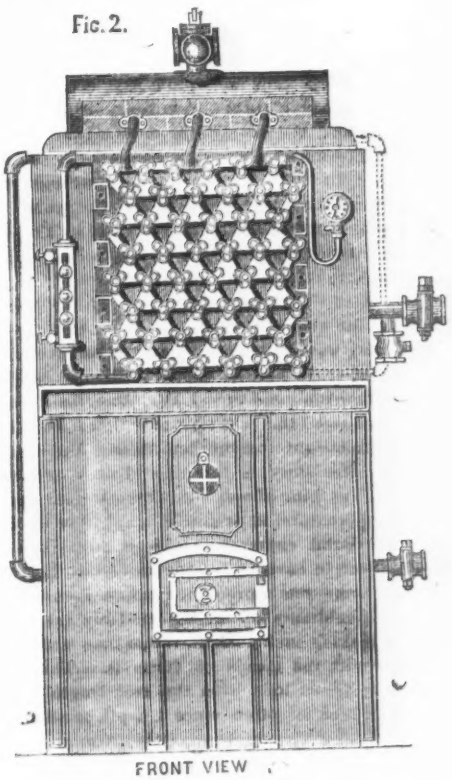
Fig. 2.



FRONT VIEW

This company is prepared to make favorable arrangements with responsible parties to act as local agents for the sale and erection of this Boiler, or for its manufacture, and to furnish to them, either the Boiler complete, or special parts. Reliable parties can obtain the exclusive right to sell for any particular locality, by paying or securing in advance a sufficient amount to insure an active prosecution of the business; such advance to apply to their credit as part payment of their orders for Boilers, complete or in part.

The Iron Pillar in Delhi, India.*

By BENJAMIN SMITH LYMAN.

The object of this paper is mainly to show on the screen a copy of a good photograph of the Iron Pillar at Delhi. It is the same pillar lately noticed at some length in the *Engineer*, in an article that has been copied into Van Nostrand's *Eclectic Engineering Magazine* (Feb. 1872).

The pillar is about eleven miles south of Delhi, and stands in the entrance court of a ruined mosque 700 years old, in front of a fine arch 53 feet high, and 22 feet wide, close by the famous Kutub Minaret; and is surrounded on either side by colonnades made up of columns built by the Musselmans out of Hindoo ruins, blocks put one on another without order. The court is commonly supposed to have been built around the Iron Pillar; but this may possibly have been brought here like the columns about it from some other place, and set up as an ornament to the court or even before the mosque was planned.

The pillar is a solid shaft 22 feet high above ground and has been proved by digging, to be at least 26 feet deep in the ground without finding its full length It is supposed to be fifty or sixty feet long; but it is not likely that very much more than half the length of so remarkable an object would be hidden away out of sight. The diameter at the bottom is 16 feet 4 inches, at the top 12 inches; the shaft is very straight and mostly smooth, and the taper is nearly uniform. The weight would therefore be from twelve to fifteen tons. The top for three feet and a half is cut into an ornamental shape, apparently with a chisel. The writer in the *Engineer* notices in his photograph the mark of the graze of a heavy round shot on one side about mid-height of the column, with a slight crack on the opposite side, as if the blow had been nearly enough to break the shaft when suddenly bent beyond the limit of elasticity.

About half way up the pillar from the ground is an inscription of six lines that was copied by Captain T. S. BURT, and described from his copy, in the journal of the Asiatic Society of Bengal (Vol. VIII, 1838), not by Capt. BURT, (as the writer in the *Engineer* seems to suppose) but by the editor of the journal, the distinguished JAMES PRINSEP. He says it is in Sanscrit in a character used about 1500 years ago; but the curves of the letters are somewhat squared, as if cut with a narrow steel chisel or punch and a hammer. The inscription says the pillar was set up by the king DHAVA, in military triumph over the Bactrians, as "an arm (or monument) of fame engraved by his sword," but gives no date. PRINSEP speaks of the shaft as unquestionably wrought iron.

The present popular legend is that the pillar was put into the ground about 700 years ago by PITHORA, the last Hindoo rajah of Delhi by the advice of his Brahmins, to establish his power forever by crushing the head of the snake that holds up the world; and that the king afterwards, in doubt, took up the shaft, and was astonished to find it really covered with blood at the bottom. The Brahmins declared the spell broken; and in fact the Musselmans soon after conquered the country, and there has never been a Hindoo government there since. A noticeable feature of this story is that the pillar is not mentioned as anything of very remarkable workmanship; nor as supernatural in origin, as is apt to be the case with wonderful engineering objects after their age and true origin have been forgotten. But this may possibly come from a profound ignorance among the modern inhabitants of the region of any great difficulty in making such a shaft, rather than from a familiarity with the means of doing it. The story must have arisen long after the real length of the pillar had been forgotten, since a depth of thirty or forty feet below ground is so little surprising, that there is a well deeper than that within a quarter of a mile. Of course the date given by the story is wholly worthless beside the indications of the inscription.

The material of the pillar has once been called "mixed metal," but would seem to be iron with the ordinary impurities of rough methods of working. It has also been spoken of as "cast" by the same writer, apparently quite unacquainted with metallurgy; but there can hardly be a doubt that it is forged. The probable mode of cutting the somewhat intricate letters (with a chisel and hammer) could not have succeeded in so brittle a material as cast iron; and the words "engraved by his sword" seem to imply at least that the cutting was done after the shaft was made. The appearance of the capital, too, the mark of the round shot, an imperfect test of a small piece of the metal, and the testimony according to their judgment of several competent British eye-witnesses of the column, all point to the character of wrought iron. My own opinion to the same effect may be added; for I saw it (from the ground only) a year ago in company with an English civil engineer, and we were both convinced that it was hammered iron.

Even aside from these points it would, perhaps, be easier to account for it as a forging than as a casting. The natives to this day have no method of making true cast iron, thoroughly fluid, but rather blooms from the ore; above all, no method that could ever be capable of casting twelve or fifteen tons at once. On the other hand, it is quite conceivable that large blooms may have been made by the method still in use (somewhat similar to the Catalan and still more like the high bloomary or Stueckofen), and that they may have been built up piece meal into a long shaft. Indeed, masses about a ton in weight that must be merely blooms, are described as still made by the natives at iron works in the Beerbhoom District, Bengal. (Journal of the Asiatic Society of Bengal, Vol. xiv, 1845, page 755).

It has been proved impossible to hammer out by hand a shaft more than nine inches in diameter, and some kind of forging by power must have been used. But, as we know that the ancients made use of very powerful battering rams worked by men, it is not at all incredible that they may have had in India, fifteen hundred years ago, large trip hammers worked by men, or even by bullocks or elephants.

(*Read before the American Institute of Mining Engineers, February 21, 1872.)

Pig Iron Production in the World in 1871.

The following is an approximate estimate of the whole production of pig iron in the World in 1871, in tons of 2,000 pounds.

	Tons.
Great Britain	6,500,000
United States	1,912,000
France	1,350,000
German Zollverein	1,250,000
Belgium	896,000
Austria	450,000
Norway and Sweden	280,000
Russia	330,000
Italy	75,000
Spain	72,000
Other Countries	200,000
Total	13,315,000

It will be observed that Great Britain produced about one-half of the pig iron made in the world last year.

Spring Course of Lectures on Science.

THE following lectures are announced to take place at the Stevens Institute of Technology at Hoboken:

Tuesday, April 2d, by President HENRY MORTON, "Light as a Mechanical Force."

Tuesday, April 9th, by President HENRY MORTON, "Polarized Light."

Tuesday, April 16th, by Professor STEPHEN ALEXANDER, "The Nebular Hypothesis."

Tuesday, April 23d, by Professor STEPHEN ALEXANDER, "The Nebular Hypothesis."

Tuesday, April 30th, by Professor A. R. LEEDS, "Chemical Force."

Tuesday May 7th, by Professor CHARLES F. CHANDLER, "Water."

Tuesday, May 14th, by Professor A. M. MAYER, "The Loadstone."

Tuesday, May 21st, by Professor A. M. MAYER, "The Earth a Magnet."

These lectures will be illustrated with all the brilliant experiments of which the subjects admit, and for which the facilities of the Institute's lecture-room and the great collections of apparatus in its cabinets give such unusual opportunities. Tickets for the entire course are $1 each; for single lectures 25 cts. Lectures will commence punctually at 8 o'clock.

New Publications.

POCKET-BOOK OF MECHANICS AND ENGINEERING, containing memoranda of facts and connection of practice and theory. By JOHN W. NYSTRAND, C. E. Eleventh Edition. Revised and greatly enlarged with original matter. Philadelphia: J. B. LIPPINCOTT & Co. London: TRÜBNER & Co. 1872.

The value to the engineer in the field of some small pocket-book giving information needed on the spot and which it is almost impossible to carry in the mind, is too well known to require comment. The former editions of the neat little volume before us are also familiar to a large proportion of our engineers, whose appreciation of their value has been shown by the fact that the work has run through so many editions.

The sources from which the information has been derived are generally conceded to be the highest and best on the various subjects. They are, for example, DALTON, on heat and air; REGNAULT, on steam; KOPP, on the expansion of water; MORIN, on friction and strength of materials; JOULE, on the mechanical equivalent of heat; the Franklin Institute, on the strength of iron and copper at various temperatures; and the Royal Technological Institute of Stockholm, on dynamics. The experiments and investigations of these learned men and societies are the basis on which the formulae for practical use have been deduced and arranged by the author.

An engineer's pocket-book comes to be regarded, after a few years' use, as an old friend, and though as our scientific knowledge advances from year to year, changes and additions must of course be made in the tables based upon observations of physical laws, still it is always pleasant and convenient to have their general arrangement the same that one has been used to. In the present edition, the author has introduced a large share of original matter, and has spent much labor and money in order to bring it, in every respect, up to the standard of the present day. We are informed in the preface that if the formulae contained in the pocket-book were put into words, they would fill a larger book than Webster's unabridged.

COAL MINING AND STATISTICS OF COAL, IRON AND OIL.—We have received from the publishers—BANNAN & RAMSEY—their *Annual Statistical Register* of the Coal and Iron Trade, to which there is added, this year, some statistics of the Petroleum trade, making a pamphlet of 88 pages octavo, full of useful facts and interesting information.

There is much needed a special professional treatise by some one or more of our best field Engineers, discussing from a purely useful or practical point of view the advantages and disadvantages of a universal substitution in field-work of the metre for the foot as a unit of our railway surveys; and another similar treatise would have a wide circulation, if written by some experienced land surveyor, stating clearly the exact amount of desirableness and practicability of a like substitution of the metre for the rod, pole or perch.

We regret to hear of the severe illness of Prof. S. F. B. MORSE, the father of the telegraph. He is 81 years old and his recovery is said to be doubtful.

THE ENGINEERING AND MINING JOURNAL.

ROSSITER W. RAYMOND, Ph. D.,
WILLARD P. WARD, M. E.
Editors.

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Fallacy in Scientific Conclusions.

Science was defined by an old latin author to be "a certain, unquestionable knowledge, derived from, or founded upon, laws or principles equally certain"—*cognitio certa ex principiis certis exorta*—and the word implies in our days "a systematic and orderly arrangement of knowledge." There are two ideas, then, suggested by the word; first, that the knowledge shall be certain and sure; second, that the arrangement of facts shall be an orderly one.

Sciences are built up, or developed, in two entirely different ways, and hence are of two kinds—*deductive* and *inductive*.

The *deductive* sciences embrace only two classes—the metaphysical and mathematical. In these the starting point is simply a few truths, which every man in his right mind *must* admit. But which no man can possibly prove. These are therefore called *self-evident truths*; or, technically, *axioms*. For instance, as a foundation for the whole science of geometry fourteen axioms are laid down, none more abstruse or difficult of comprehension than the statement "the whole is equal to the sum of all its parts,"—and nothing could be more impossible of proof than this general proposition. Starting out with these as a foundation, and a few definitions, agreed upon by common consent, as tools, a strict process of reasoning leads to results of marvellous importance, and which are free from any fallacy in observed facts—precisely where most elements of doubt creep into inductive sciences. The only source of error in a purely deductive science is that the reasoning may be fallacious; but, as a rule, this process is so simple that with due care an error can scarcely go undetected. Of course we leave out of account purely mechanical mistakes, like an error in multiplication or division, which no more invalidates the science as such, than a typographical error on the printed page of the book which teaches it. Hence the certainty concerning mathematical conclusions which has grown proverbial.

To create an *inductive* science a group of phenomena related to each other are brought together, arranged, classified and carefully considered in all their relations; by this process certain laws are induced, and so a science is founded. At this point it is safer not to dignify these induced rules by the name of *laws*, but call them only *theories*; and going still farther apply to the theories the process of deduction. Combine one point of this theory with another point, or with some universally admitted fact, and you will have some result, perhaps a very unexpected one. Submit these conditions to the test of actual experiment—called then *experimentum crucis*—and if the physical result fulfills the previous prophecy, you have the most forcible proof that the theory is really a correct one. As an instance of the practical distinction every day made between a theory and a law, we may cite the *law* of gravitation and the wave *theory* of light, which were arrived at by precisely analogous processes. The rule by which we suppose bodies to attract each other, has served our purpose so long in calculating eclipses and all other kinds of astronomical phenomena, that no one pretends to dispute its accuracy, and it is therefore universally conceded to be one of the laws of nature. On the other hand, the wave theory of light was propounded as a rival to what was previously supposed to be the *laws* of light. It has gradually fought its way into general confidence, and although to-day it is probably believed to be true by more than nine-tenths of all the scientific men in the world, it still bears only the designation of a theory.

It must be remembered that these formulae which we induce from the classification of a large number of facts, and which we call laws, are not always like those of the Medes and Persians which could not be changed. They are nothing more than the generalization by human minds of a large number of human observations, and for this reason are not infallible. On the contrary, they contain always three sources of fallacy; either the facts may have been well and accurately observed, but the process of reasoning may have been faulty; or, the reasoning process may have been rigidly conducted but the facts may have been badly observed; or, lastly, the reasoning may have been beyond cavil, and the facts, as far as they went, may have been accurate, but the observations may not have extended over a sufficiently wide field. All these sources of error exist in all sciences which are founded on human observation, and which are known as inductive sciences.

Unfortunately all the physical sciences belong to this class. Capable physicians may differ as to whether bleeding or stimulation ought to be resorted to in a given case; botanists may honestly differ as to the family to which a new entirely new plant ought to be assigned; zoologists disagree as to whether certain low forms of life belong to the animal or vegetable kingdom; and chemists are not yet all of one mind respecting their special science. But a quarrel between two mathematicians as to whether the square on the hypothenuse of a right-angled triangle is equal to the sums of the squares on the other two sides, would be a phenomenon beyond human comprehension. The proposition may be proved in over forty different ways; but when once proved in any one way, it stands, beyond the possibility of a doubt, for all time. It is because deductive sciences are so positive, and mathematics is a deductive science, that all other sciences become accurate and certain just in proportion as they admit of the application of mathematics. Astronomy is, probably, to-day the most accurate of all the natural sciences, and is so, simply because it admits so freely of the application of mathematical reasoning.

In order to apply mathematics to any natural science it is necessary to have some observed data in connection with that science, and it is among these observations that errors creep into all natural sciences. Many of us recollect the celebrated mathematical demonstration by Prof. LARDNER, proving that it would be impossible for a vessel to cross the Atlantic Ocean, propelled by steam power alone. Now, in his demonstration the fallacy did not lie in the mathematical principles or processes which he used, but in the data to which he applied them.

We have already on several occasions alluded to the necessity for thoroughness in scientific knowledge, and as we have hitherto refrained from inflicting upon our readers the old couplet about "a little knowledge," we will spare them now also. But we think that when all professions are crowded with incompetent, half-educated men, a little plain talk on the subject of true science is not amiss. Schools for the training of young men for a variety of paths in life have multiplied with great rapidity throughout the country, within a few years past, and the old notion that all young men who are to receive a good education must go to the stereotyped American college, is now giving way in the face of the light which Germany has shed upon the subject of education, and the unmistakable demonstration she has made as to the value of her system.

One of the chief characteristics of the German system is, however, its thoroughness, which may be placed even before its variety; and in modelling our system after hers, we must be careful that this feature is not overlooked.

The damage which errors, on the part of men who are supposed to be scientific, do the cause of science is oftener under-estimated than the reverse, and it is easy to see that errors in scientific investigations are always due to the incompetency of the searcher after truth. If his logic is bad, he is an incompetent logician; if his facts have been badly observed, or the observations incorrectly recorded, he is an incompetent observer; and, finally, if he has not extended his observations over a sufficiently wide field, he shows that his education has not been sufficiently liberal in its scope to give him the broad views, and the wide range of vision, which should characterize the theoretically perfect scientist.

It is true that no human being can expect to become a perfect master of inductive science; for to reach that end he would have to know everything, and possess infallible reasoning powers; in other words, his mind would have to be infinite instead of finite. But we continue to approach nearer and nearer to the limit, as the asymptote approaches the curve, and the efforts of all true friends of science and education are concentrated in promoting the movement in that direction.

It may be urged that all men have not the natural ability requisite to assist, even in an appreciable degree, the onward march of science.

All men do not possess the natural traits of character as to order, care, or the logical mind which is so indispensable; but while we grant the truths of these statements, we are of the opinion that many more men have these traits, and this ability, than ever have a chance to display them. In some cases an entire life is passed without the offering of a single

opportunity for the display of these talents in such a way as to attract general attention; yet in the vast majority of instances, notwithstanding the fact that they never come to the surface, and are never clearly seen, they help along the great work somewhat, and it is often due to the deficiency or the defects in training, that they are not of vastly more assistance. We must see to it that our system of education is planned and carried out by men of large experience and thorough education, for in this way we can probably assist the cause of science more than in any other.

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Utica Steam Engine Co. (formerly Wood & Mann Steam Engine Co.,) 42 Cortlandt street, N. Y.

Post & Goddard have removed to No. 111 Liberty street. Dealers in Taps, Dies, Reamers, Drills and supplies generally.

Peteler Portable R. R. Tracks and Cars. Miners and Contractors, send for circulars, 42 Broadway, N. Y.

American Submerged Pump. Power attachment—cheapest and best in the market, 55 Chambers street, N. Y.

Roper Caloric or Hot Air Engine, 124 Chambers St.

Blake Bros., New Haven, Conn., manufacture Stone Breaker for crushing ores and minerals of every kind into small fragments, preparatory to their further comminution by other machinery.

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. It is believed that several names of members and associates elected at the Bethlehem meeting in Aug., 1871, have been accidentally omitted by reason of the loss of a portion of the records of that meeting. Such persons, or their friends, are requested to communicate with the Secretary.

II. All members and associates who have not paid their dues are requested to do so at once, by sending in postal orders, or check, or money, ten dollars to the Secretary.

All members and associates who pay their dues for each current year, strictly in advance, will have sent to their address, regularly and weekly, the ENGINEERING AND MINING JOURNAL, which is the organ of the Institute, and will contain the proceedings and transactions, and all important papers read before the Institute, and all notices of meetings. Back numbers cannot, as a general rule, be sent.

III. It is expected that the more important papers read before the Institute, and the debates thereon, will be published in annual or semi-annual volumes to which those members and associates will be entitled who have paid their dues.

IV. Authors of papers are requested to notify the Secretary in advance of the meetings, giving the subject and length of their papers. Attention is also called, in this connection, to Rules 12 and 13.

Instruction in Blow-Piping.

WE desire to call the attention of our readers to an opportunity for instruction in the use of the blow-pipe which is seldom offered.

Mr. CORNWALL, one of the assistants at the Columbia College School of Mines, and the translator of RICHTER'S and PLATTNER'S work, is now forming a class for private instruction in a branch, a thorough knowledge of which is exceedingly valuable to the prospector or the mining engineer. We have no hesitation in saying that Mr. CORNWALL is as well, and probably better, posted in this branch than any other man in the country, and we would most cordially recommend any one who desires a good knowledge of this short and easy method of analysis to attend this course, the terms for which are very reasonable.

Blast Furnace Fuel.*

BY S. H. DADDOW.

In the Pottsville district the lowest workable coal bed is B, of the Pennsylvania Survey and this, with rare exceptions, may be said of all the other anthracite regions. There are, however, a few local deposits of coal, even below A, which attain considerable dimensions, but they are not persistent, and have no commercial value. A, in our nomenclature, is the lowest bed that has a general spread or horizon. It is seldom workable, but always under B, which is always of workable dimensions except when divided. This bed, B, unites and divides, or *vice versa*, without rule or regularity; but generally, even when divided, each division constitutes a workable bed, and this peculiarity is as marked or prominent a feature in the bituminous coal-fields, as it is in the anthracite fields. In the anthracite regions, however, B is generally, if not always, a single bed of considerable dimension in the eastern end of the coal-fields, or basins, and a divided bed, or two beds, in their western extremities; but, while the former condition seems to be a rule, the latter does not, because we find B as a single bed of great dimension in the western end of the Lehigh Basin of Black Creek, and as the "grand tunnel bed" at Nanticoke, in the Wyoming coal-field. In the southern coal-field B is usually under vast masses of conglomerate strata, and, though resting almost invariably on the hard conglomerate without the fire-clay floor—it is usually accompanied by the prevailing roof-slates of all our coal-beds. In the Lehigh Basins this overlying rock is frequently denominated the "buck-wheat" rock, on account of the large mica scales, like buck-wheat chaff, which it contains abundantly. This micaceous rock is a coarse sandstone in the western bituminous fields. In the Great Kanawha region of West Va., it is very thick, ranging from 40 to 70 feet, with a few slaty divisions, sometimes resting on the coal, or only divided by a thin slate. Near Malden, some six miles above Charleston, large areas have been excavated, an acre or more in extent, where neither pillar nor prop are provided to support this sandstone roof; and yet it is as solid as a bell. This, however, is at a considerable depth, where the slates have been cut a thousand feet deep by the Great Kanawha river. Near the outcrops, this rock is more soft and friable, and the mica more noticeable. But exposure wears this rock; fire and frost however, have little effect, except when exposed to rain—or the thawing and freezing process. On the Green river in Kentucky and the Big Muddy in Illinois, this rock is prominent above bed B, but in the western coal-fields the micaceous rocks are not confined to the lower beds, while the micaceous sandrock overlying bed B is not conclusive proof of identity; it is, we believe, the first micaceous sandrock overlying the millstone grit in the Alleghany coal-field, of any great thickness. There are a few thin beds, divided by slate, between A and B, but nothing so distinctly marked as the great micaceous sandrock, above B.

The second proof of identity is the burr-stone flint or ferriferous limestone, and its accompanying ore bed. A small coal seam, and sometimes two of them, intervene below the limestone and above B, overlying the micaceous sandstone.

The third proof of identity is its double character. It is nearly always separated by a stratum of slate or fire-clay in the west; but in the east by slate or rock—ranging from one inch to twenty feet, and even one hundred feet in thickness, when rock intervenes, as it frequently does in the anthracite regions. In the valley of the Great Kanawha, we have seen this bed worked, where only a few inches of "mining" or soft slate, parted the coal at one place, one to two feet at another, and twenty feet of slates and fire-clays at other points, all within a few miles; while at the Mount Carbon mines on the Big Muddy, in Southern Illinois, the same features are predominant. In many other places we might illustrate this peculiarity, but the foregoing will be sufficient on this point.

The fourth proof of identity may be found in the coal itself—its appearance, fracture, constituents, combustion, and ashes. It may generally be denominated a "block coal" on account of its tendency to split into oblong blocks rather than cubes. The coal of E is usually cubical or conchoidal, even in the bituminous districts, while that of G is sometimes cubical and sometimes oblong in fracture. In appearance the coal of B has usually a dull satin lustre, while that of G, or the Pittsburg, is more bright and silky in appearance. G has the lustre of a pure anthracite; B more that of splint and cannel. E and G coals generally decrepitate under a strong heat, but if a caking coal, readily unite again as coke.

The coal of B seldom decrepitates under heat, except where mined from the out-cropping edges of the bed, and while it will generally form a coke under the usual treatment, it does not usually agglomerate in mass, and subsequently separate under heat into oblong shapes, in the form of Pittsburg or Youghiogheny coke, but each lump forms its independent mass of coke as a rule.

The ashes or incombustible residue of the lower stratum of B is *red* or *pink*, both in the anthracite and bituminous coal-fields. It usually contains more earthy residuum than E or G; but while it contains more silica and iron than those beds, we think it may be safely stated that it also contains less sulphur, phosphorus, and other more objectionable impurities. It clearly is not as highly bituminous as the coal beds overlying it, owing, undoubtedly, to the superior heat under which it was formed; and for this reason we think it also contains less of the chemical impurities, which must have been vaporized in these early stages of coal formation.

In the anthracite fields the same causes evidently existed, for there we find the lower coal beds, there formed below A as local deposits or nests, made up of slates, plumbago, carbonaceous shales, coal dirt, and occasionally pockets of "shelly coal." A is usually thin, generally half silicious "bone coal," and contains from 10 to 30 per cent incombustible matter. B is sometimes thin, and known as the big "rough vein" in some parts of the Pottsville district, and in such cases contains too much "bone" and silicious impurity for use as furnace fuel. This impurity is, however, local, and is rather the exception than the rule. Generally, it produces an excellent furnace fuel, but more particularly in the anthracite fields. But in these coal-fields the hardness, density, and general purity of the over-lying beds even to G., constitute them available furnace coals, consequently the coal of B is not exclusively sought after. The effect of heat is as noticeable—indeed it is much more evident in the anthracite than in the bituminous formations, since it has expelled the bitumen, or volatile constituents of the bituminous coal, leaving anthracite, or the carbon and silica, nearly pure. In the upper anthracite beds, we find a gradual change from the hard anthracites to the semi-anthracites, which is almost as noticeable as the change from east to west.

As a fifth proof, we may properly cite the fact that No. 1 B in the anthracite fields has been proved, by Prof. LEQUEREUX, of Columbus, Ohio, as No. 1 B in his bituminous sections, particularly in Western Ky. We are aware that this learned paleontologist differs from us in the construction of his western sections; but he says there is a clear identity between the Baltimore bed, at Wilkes-Barre and No. 4 E of his western sections; and since we prove our mammoth E and the Baltimore bed E to be identical, no further obstacle remains to a general identification.

We have not the time or space to discuss the causes of disagreement, but will state broadly that it arose from the fact of mistaking our Mammoth, or E, for B, or the lowest great bed of the anthracite fields. When Prof. ROGERS and his assistant geologists discovered the mythical character of the once famous Jugular, it was too late to correct many of the sections formerly made consequently, this bed appears in some of the Pennsylvania sections. But they, as well as many others, then went to the other extreme and recognized only one workable bed below the Mammoth.

But we may be allowed to suggest another cause of difficulty in identifying our Eastern with our Western coal-beds. We merely make the suggestion, however, because we have not the data to substantiate the propositions:—We submit that the paleozoic horizon is lower, in the lithological structure of our Western, or trans-Alleghany sedimentary formation, than in those of cis-Alleghanian deposits; that the greater intensity of heat in the eastern formation and its longer continuance, prevented the existence of organic life to a later date, than in the western formations, where we find the evidence of a lower temperature. Should we call this evidence in question, we shall be at a loss to account for the difference between anthracite and bituminous coal.

We cannot close this proof of identity without giving the fact that Prof. LESLEY, whose experience in the geographical and topographical sciences and their ration to our coal-formations is unrivaled, corroborates the

* Read before the American Institute of Mining Engineers.

position we take in regard to the identity of B throughout our western coal-fields. In fact, No. 7 of the foregoing sections, is a faithful copy from Prof. LESLEY's "Manual of Coal and its Topography."

The question therefore simply resolves itself into one main issue. The identification of our western beds with those of the east, the trans-Alleghany with the cis-Alleghany, because we find no difficulty in connecting the anthracite with the semi-anthracite, or the semi-anthracite with the semi-bituminous, and personally we find no difficulty in connecting the semi-bituminous with the bituminous, or the latter with the highly bituminous.

Though it may not be necessary for our purpose to demonstrate further the place and identity of the coal-bed B in the coal measures, we may be able to identify our coal-fields or their lithological structure in reference to the identity of B. It is true, that conglomerate rocks encase the coal-beds in many localities even as high as K and N in the Pottsville district. But they recede in the middle coal-fields below E with a few exceptions, and at Scranton we find no conglomerate above B, yet the coal beds are clearly identified. Another step westward brings us to the semi-anthracites of Sullivan and Bradford counties, where beds A and sometimes B are in the conglomerate; while in the Broad-top semi-bituminous field the conglomerate is below A. From this place, which may be denominated cis-Alleghanian, there is little or no change westward; the conglomerate, or millstone-grit, underlies A closely, wherever developments have been made to expose them, or these rocks out-crop beneath the coal.

We cannot, therefore, escape the fact, that A was deposited in the West in the same era that A was formed in the East.

We will cite only one other lithological evidence, in the horizon of the great rock denominated, generally, the "Mahoning sandstone." We will save time and space, by simply referring to the fact that Prof. LESLEY calls this the "FIFTH GREAT SAND-ROCK," of our Appalachian system.

This great rock is as marked in the anthracite as it is in the bituminous coal-fields; and, just where it ought to be, in the same relation to the coal-beds and the millstone grit, or conglomerate, here, as there. There is no workable coal-bed in the anthracite regions between E and this great sandstone, and there is none in the West. The fact that E is a single bed at some points and double and even a treble one at others, will account for a seeming contradiction of this assertion.

All our shafts to the Mammoth have penetrated this bed of sandstone, if they exceed one hundred feet in depth, and the miners who sink those pits at St. Clair, Wilkesbarre, or Pittston, will easily recognize these massive formations of sandstone and quartzite rock.

In the Wadesville shaft, near St. Clair, Pa., it is a quartzite, or conglomerate rock, eighty-three feet thick, divided by a thin bed of coal, one foot eight inches thick, without slate or fire clay; while the space between G and E in the anthracite, may be as appropriately denominated the "Lower Barren Measures," as the same space is thus known in our western sections.

We have thus hastily glanced at a few of the most prominent geological and commercial features of this vast horizon of coal, in its wide-spread from the waters of the Schuylkill to the banks of the Mississippi, and from the Lehigh to the waters of the Alabama, holding to view one broad sheet of coal, of uniform, though excentric character throughout. Accompanying this great lower bed, we find a vast plate of peculiar rock, still more extensive in its horizon and more uniform in its character; while other coal-beds and other rocks overlie this lower coal-bed (B) and the millstone-grit, with still greater regularity and uniformity in character and feature.

Aside from the main object of inquiry, may we not be permitted to ask: Is not this great coal-bed too big for adaptation to any of the commonly accepted theories (if any are commonly accepted) of coal formation, and do not these great and wide-spread plates of uniform rocks present awkward difficulties, in the mind of the geologist, whether he accept the Drift or the Marsh theory?

In treating even generally of the character of B as a coal-bed we cannot overlook its local peculiarities. These, however, may be briefly noted, because the description of a few local or peculiar features will embrace all of any importance.

First, the out-crops of B are much more impure, generally, than the out-cropping coal of any bed higher in the measures, or such has been our experience in a long and extensive acquaintance with it in many localities. That sufficient reason can be given for this fact we are not sure, but we think that two main causes exist, the first being the fact, that out-crop occupies the outer edges of the coal-field, and consequently, must have touched the shores of the great sea in which it was formed; and, in such connection, must have been exposed to the earthy impurities of the land adjacent; while the second cause results from the same condition, because the chemical impurities, vaporized in the interior, would condense more readily, on the edges of the sea.

The second great or leading peculiarity is in the fact, as far as our observation goes, that the out-cropping coal of B in all bituminous localities partakes more of the caking, or coking quality, than the coal of the same bed in the interior of the same basins. This may not be a rule which is invariable, but we have noticed this peculiarity in many localities. Indeed, we do not know the coal of this bed to be used in a raw condition as furnace fuel except where mined from considerable depth, or, when obtained from localities where rivers or streams have cut deeply into the coal measures. We may cite the great Kanawha, W. V., the Green river, Ky., Brazil, Ind., Mahoning Valley, Ohio, and Big Muddy, Ill.

We do not think there can be any error in stating, that B has furnished all the raw bituminous coal that has ever been made available as furnace fuel for the production of pig iron in the west, and we think it more than probable, that all or most of the available furnace fuel of the interior will in future also be derived from bed B. It evidently increases in purity, as it certainly increases in hardness and density as its depth from the surface increases, or its distance from its original out-crops. But in all cases a solid sandstone top over its roof slates seems to be a necessity for the production or existence of a pure furnace fuel. There may be, and undoubtedly are, many other local causes which interfere with general rules; but the fact is patent that furnace fuel in the form of raw bituminous coal may exist, and most likely does exist, in a wide area beneath our western, or bituminous fields and that it is not confined to the eastern, western, or southern margins of the Central coal field, or to the West and centre of the Alleghany field. How far from the original margins of the ancient sea Ashland in Kentucky, or the Mahoning Valley in Ohio, where "block" coal, or furnace fuel is now mined, may have been, we cannot tell; but we find this coal in the deep interior of the Alleghany coal field, where the Kanawha has cut over a thousand feet into its rocks, as well as near its present out-crops at the former places. We would, therefore, be justified in anticipating the same results from a shaft, penetrating to an equal depth in the heart of the Illinois or Central field, because we find the block-coal on both sides, as well as at the southern end of this great field, at Brazil in Indiana, on the Big Muddy in southern Illinois, and in Muhlenburg county, Ky., on Green river.

In the interior of our country, great centres of the iron trade appear looming up in the near future. The poetical writer, who once pictured the banks of the Ohio and the Mississippi aglow with blast furnaces, did not paint an entirely fanciful picture, as those who have floated at night down the great river of the West, will readily attest, when they remember the lurid glare which lighted the dark waters at Carondelet and Grand Tower; while those who can realize from experience the unlimited resources of the Iron mountains and knobs of the Ozarks, and their significance in proximity to the vast coal-beds of the Prairie State, or the still more extensive bounds of the Central coal-field, will not doubt the possibility of a wider illustration of the picture in the near future.

If we are correct in our estimate of coal bed B as a source of furnace fuel, Belmont and Cairo are as available for furnace sites as Carondelet, and Evansville, or Paducah as Grand Tower. The brown and red oxides of Missouri are no less extensive or less valuable than the magnetic ores of iron, while the limonites of the subcarboniferous and the carbonates of the coal measures in western Kentucky, are practically unlimited; but these immense resources of iron would not be so significant, or pregnant with future greatness, were not the coal for furnace fuel equally as available and exhaustless. From close and careful investigation we are convinced that of the two—Iron and Coal—the latter is the most abundant and most available to the lower Ohio and the Illinois and Missouri shores of the Mississippi.

But the acquirements or developments of the present, are only the indication of the possibilities and probabilities of the future.

The coal of B in the Central field is, however, as available to the ores of Lake Superior, and the furnaces of Chicago, or the steel mills of Joliet as to the ores of the Ozarks, and the furnaces of Carondelet or Grand Tower. The development at Brazil is but an earnest of a far greater promise of production of B from Clay county, Indiana, to Kankakee and LaSalle, Illinois. Literally from Brazil to Peru.

The fact that the iron industry grows where coals and ores are developed, by accident more than design, will not be evidence to the Engineer that the most available localities are therefore occupied or chosen as furnace sites. Our Iron masters are guided by that which is seen rather than that which is known—more by palpable evidences than scientific faith, and yet some practical experience is necessary to make the one or the other reliable. We think the practical man, who ignores science, as fallible as the scientific man, who evinces contempt for the practical. Science is infallible, yet scientific men may err: facts and figures do not lie, and yet they lead to grave mistakes. It is the office of the Engineer—and particularly the Mining Engineer—to gather facts from the geologist, the chemist and the metallurgist, to glean the rich fields of experience, and to separate that which is really practical, from that which is merely dogmatical. His duties are of the highest order, yet to be useful he must obtain confidence; to be successful he must deserve it; to be trusted, he must be true; to inspire faith, he must be faithful.

That which the Great Kanawha river has done for West Virginia, in developing the ores and coals in the deep basins of the Alleghany coal field, may require many hundreds of deep pits in Indiana, Illinois and Kentucky. The deep coals of the lower Ohio are not so deep geologically, as are those developed on the Kanawha; nor are the coals of B so deep beneath the upper Ohio, from the furnaces of the Mahoning to those of Ashland and Ironton. Consequently, that which nature has done in West Virginia, the Engineer may accomplish, for all practical purposes, in Ohio, Indiana, Illinois and Kentucky, whether he explores in advance with the diamond drill, or plants the pit on the evidences of geology.

Great faith is not necessary, because the steps in advance may be cautious and sure, and yet our future iron industry need not be confined to local circles, whose boundaries only increase by timid ventures around the parent enterprise. The out crops of B and the field of the probable existence of furnace fuel traverse the length of Ohio from North to South. These outcrops may be found much nearer Cleveland than Pittsburg, while the coal-bed itself may exist less than a thousand feet beneath the latter city. The furnace coal of Ashland may be more available to Ironton, Ohio, while Portsmouth may be nearer its out-crop; yet here the ores at first glance would seem deficient; but when we examine the vast range of the subcarboniferous rocks, and the ore beds which they contain and the many workable ore beds of our western coal measures, we cease our anxiety. Indeed the iron mountains of Missouri and Michigan sink into insignificance in comparison. We have found in our Western coal measures from five to ten feet of workable ore, mostly carbonaceous and calcarious, in beds of from twelve inches to two feet thick, in connection with coal beds or soft slates. Were we to estimate these beds as underlying even one tenth the coal area of the Alleghany and Central fields, or available to that extent, the calculation would seem visionary; yet we find one of these ore-beds which is easily recognized, at Johnstown near the eastern out-crops of the Alleghany coal field, and on the Great Kanawha, near its deep centre.

While the ores, which we find in the deep basins of the Kanawha, we also find in those of the Central coal field on the Green river of Kentucky.

The richness, and consequently superior yield of the Missouri and Michigan ores increase their value in proportion. But the ores of the Ozarks, and the coal of the prairies can never be as available as the ores and the coals, which exist in close proximity on the mountain sides of the Kanawha.

The coals of the Kanawha are harder and consequently less friable than the furnace coals of more distant localities, consequently, we think it may be safely stated that two tons of Kanawha coals would have more effect in the blast furnace than two and a half tons of the furnace coals of Illinois; and in the same proportion, we use less of our hard anthracites to produce a ton of iron than would be required of the superior bituminous coals of the Kanawha. But, the most important question after all, is the relative distribution of carbon; and in this relation Providence has compensated the East to a remarkable degree in her coal for any advantage the West may possess in ores.

We think the hematites and carbonates of the Kanaw-

ha, can be reduced to iron, equally as cheap and equally as good, as that which can be produced from the ores of Missouri: for rich and valuable as those ores may be, the iron masters of Carondelet are anxious to mix them with the limonites of western Tennessee and Kentucky.

Yet, however cheap the coals and ores of Western Virginia may be elaborated as iron, it is scarcely doubtful if the iron of the Lehigh, the Schuylkill, and the Susquehanna may not compete. But their resources of ore must be cis-Alleghanian. It will be impossible to depend on the interior for supplies of ore, and the West for a market, and yet compete with the interior.

Our resources of ore are sometimes doubted in the East, and it is true that the hematites do not seem equal to the demand of our future necessities; but having spent considerable time in the investigation of the carbonaceous ores of the anthracite coal measures, we feel justified in giving it as our opinion, that they will ultimately take the place of the hematites, or materially aid in our production of irons. It may be remarked, however, in this connection, that twenty years ago the supply of hematite seemed more limited than at present. Yet now the demands are ten times heavier than then.

It is well known that the magnetic ores are confined to the azoic rocks, and almost exclusively to the metamorphic slates, or altered sedimentary rocks which crown the gneisses and form the base of the paleozoic, or sedimentary formations. Wherever those rocks or slates are exposed, magnetic ores are almost invariably found, whether in the East or West, North or South. They are generally of a later era than the silurian rocks—perhaps than the carboniferous—but of an earlier formation than the new red, or mesozoic, of our Eastern deposits following the age of coal, with a few exceptions. After a careful investigation, we conclude, that a great portion of our magnetic ores between the Lehigh and the Potomac, and particularly between the Lehigh and the Schuylkill, are covered by the new red sandstone. Much of this, however, we think may be made available by shafting through the new red, being guided by geological evidences, magnetic attraction, or the drill. The fact that our magnetic beds have been and are worked to a great depth, prove their continuity as beds, and consequent existence under the inconformable new red sandstone; and here we think our resources of magnetic ores will be unlimited, and engineering skill will be the "open sesame" to utilize them, unless we wait as usual for some venturesome miner to be the pioneer, or some lucky chance to unlock these treasure vaults.

It was our intention to give some reasons why we may anticipate the use of raw bituminous coal from Bed B in our Eastern blast furnaces, on the escarpments of the Alleghanies, but our allotted space is full, and we must now close with a single remark.

Having traced coal bed B, of the Appalachian formations, to the Mississippi, in the Central coal field, we anticipated at one time the data to prove its spread to the base of the Rocky Mountains, but after digging through the coal measures of Kansas 700 feet, and developing workable coal at that depth, below the Missouri at Leavenworth, we found the evidence insufficient. The measures penetrated are either the "Upper Barren" of Pennsylvania, or entirely distinct from the Central coal field. If the former, then fully one thousand feet of coal slates exist below the bottom of Leavenworth shaft and the productive coal beds of the East; but if the latter, then we know little of its character: though the evidence is conclusive that an immense coal field ranges parallel with the Rocky Mountains. The outcrops of the true carboniferous coal beds may not appear on its Western margin, because the Permian and Tertiary strata may lie unconformably on them.

It is, however, an interesting question to the engineer and geologist, because on the character and availability of the coals of the Rocky Mountain coal field will depend the economic elaboration of the ores of that great metalliferous region—and perhaps the other question of a centralization of the iron industry.

MINING SUMMARY.

Arizona.

The Prescott *Miner* of March 2 has the following review of

MINES AND MINING.

We feel so joyful over the brilliant prospect which now presents itself to our miners, that it is with difficulty we can write, much less select phrases which will relieve our mind of its subsequent hope and cheerfulness. God, in His mercy has heard the prayers of the people of this Territory, and, at this writing, Wednesday evening, the mountain ranges south of Prescott, in which our quartz and placer mines are located, hold, on their surface, between three and four feet of snow, and it is snowing as we write! Now, this is a boon, a blessing, for which our people have long prayed, and for which, no matter what others may do, *we* must sincerely thank the Great Jehovah—the good, just and benign Ruler of the Universe!

For nearly three years have our people had to bear up against drouth, hostile Indians, public slanderers, and the rule of an acursed, destructive, mis called "Peace" policy, the pressure from all of which had well nigh destroyed all hope in our breasts, when the "beautiful snow" commenced falling from Heaven, gladdening all by its presence, and enlivening the dullest citizen with visions of prosperity.

And why? some people may ask. Because it will soon melt into water, which water will be used by miners to work auriferous quartz and gravel, the working of which will give employment to a great many men, and put plenty of gold in circulation, thus making "times" good for all, and allaying a feeling of discontent with the Territory which, from causes heretofore stated, had made croakers of about two-thirds of the civilized population of the Territory. This, then, is why we so joyfully hail this timely fall of snow.

Over on Lynx Creek are some 50 or 60 placer miners, who, by "raking and scraping" together nearly all of the little water that has flowed down on the bed-rock, have been enabled to wash just about as much gravel as yielded each one a living—perhaps a little more. Now, then, as soon as the water increases, which it will shortly do, many of these miners will use sluices, and, of course, take out more than double the quantity of gold which they have heretofore been enabled to collect. Then, Lovejoy and others will go to work in their hydraulic diggings, farther down the creek, and, judging from past results, at least $10 per diem will be washed out for every man they may employ.

Black Canon Creek, Big Bug, Turkey, the Hassayampa and other creeks will bristle with picks, and the rich, but dry gulches in every mining district in this portion of the Territory will not be forgotten. Quartz mining will also be helped out by the water, and the prospects for the investment of more capital in this sure-paying branch of industry will be greatly strengthened. The Del Pasco mill, which has never yet failed to pay, will be run night and day, with results that cannot but please the most sanguine. Other mills, now idle in this vicinity, will, we hope, be started up, and so, we feel certain, several arastras. Yet, but little can or will be done until suitable mills or reduction works for successfully treating all classes of gold and silver ores shall have been erected. It is of but little use to us, at present, to know that the Tiger, Lorenna, Benton and numerous other gold and silver lodes in Bradshaw, Tiger, Pine Grove, Hassayampa, Turkey Creek, Black Canon, Big Bug, Walnut Grove, and other districts in our mountains are rich in gold and silver, so long as their owners are unable to treat the ores here, for, rich as they are, owners cannot now get the ores out of the mountains and ship them to San Francisco, when every ton of ore thus shipped costs, for carriage, at least $200. Yet, they have done so, when roads were good and dry. This being the case, we call upon the mining capitalists of California and Nevada to come or send here, and learn the fine chances which await them.

The latest news from the Tiger is to the effect that the tunnel was in a distance of 180 feet, from the bottom of the 100 feet shaft: that rich ore was plenty and getting plentier. Yet, their is no mill to work the ore of this ledge, or, rather mine, for mine it is now proven to be.

The same is true of many other mines, which we could name.

In Wickenburg, of all the districts in this county, is good, systematic milling being done, by the Vulture mill, and even there the company is laboring under great disadvantages, for want of sufficient capital to construct a railroad from the mine to the mill, over which ore—rich and poor—could be hauled for a tenth the amount of what is now paid for that service. But this capital, we learn, has been promised, and the Superintendent, Mr. MUDGE, has already gone to San Francisco to see about getting it. There may be some hope for the people of Prescott and vicinity in the following, which is copied from the San Francisco *Alta* of the 14th ult. It is news of the incorporation of the rich and well-known Benjamin mine:

Benjamin Gold and Silver Mining Company. Object: To mine for gold and silver ores in the Territory of Arizona. Capital stock, $2,000,000, in 20,000 shares. Trustees—GEORGE D. ROBERTS, G. W. CURTIS, JAMES A. ANDERSON, JOHN W. GASHWILER, SAMUEL P. MIDDLETON, GEORGE W. KITTREDGE, WM. H. SEARS.

Among the incorporators are some of the ablest, richest and most enterprising mining operators on the Pacific Coast. So it is fair to presume the company means business.

Very good news has reached us from Fort Rock District, which news is to the effect that very rich deposits of silver ores, similar to those found at White Pine, Nevada, have recently been struck.

MOHAVE COUNTY.

The news from Wallapai District, though meagre, is better than any we have heretofore received. A great many mining properties have recently been sold, for cash, to men who are erecting mills and reduction works, and general prosperity reigns throughout the district. The editor of the Los Angeles *Star*, speaking of the district, in a recent issue of his paper says:

"The Sheriff of *Sacramento District*, [Mohave county.—Ed. MINER,] Mr. WILBURN, sends us by the hand of JOHN BEAVERS, some fine specimens of ore from the Lone Star ledge, Mineral Park Disrtict. In parts of this ore the native silver can be seen and polished with a knife blade. The Lone Star Company has a five-stamp mill in full operation and is doing a fair business. We shall add these specimens to a collection which we are forming. From the hand of Mr. J. A. TALBOTT, we are in receipt of a fine specimen of silver, gold and copper mixed ore from a new discovery which was made by DAN INGLESON and promises to become the richest in the world."

YUMA COUNTY.

Mr. BURGER'S mill, near Ehrenberg, is almost finished, and work upon the mine is progressing favorably.

At Castle Dome, a short distance above Arizona City, miners are taking out a great deal of ore, containing silver and lead, which they are shipping to San Francisco.

MARICOPA COUNTY.

A letter from Florence, of date February 22d, has the following;

The last heard from the Silver Queen, they were down 18 feet on the ledge. The ore is rich in gold, silver and copper.

The weather is beautiful and warm, and vegetation is looking green. No signs of rain for the present.

The Pimas have gone out on a scout, in search of some horses they lost a few nights ago. Hope they will have success and bring in a few Apache scalps.

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The special advantages of the ENGINEERING AND MINING JOURNAL, *as a medium for advertisers, are so great and so widely known that it may seem almost needless to call attention to them. It is extensively circulated among the engineers of the country and takes a position in this respect before any other publication of the kind. It has a large and constantly increasing circulation among miners and mine owners, and men connected with mining operations generally. As it is the only paper in the country that makes this subject a specialty it has this field entirely to itself, and is the only direct and reliable means of reaching this class of persons. Being kept on file by almost every subscriber, it is doubly valuable as a permanent means of keeping an advertisement before the public. It is the Organ of the* AMERICAN INSTITUTE OF MINING ENGINEERS, *and is regularly received and read* BY ALL THE MEMBERS AND ASSOCIATES *of that large and powerful society* THE ONLY ONE OF THE KIND IN THIS COUNTRY. *It is therefore the best medium for advertising all kinds of machinery, tools and materials used by engineers or their employees. It is the recognized organ of the coal trade, and is taken extensively by the trade throughout the country, and presents the very best means of reaching that very important class of men.*

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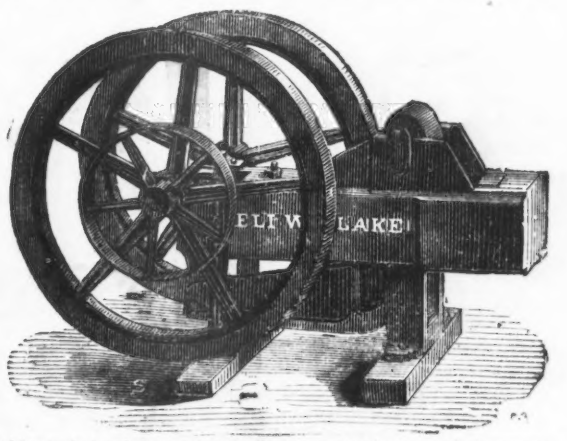

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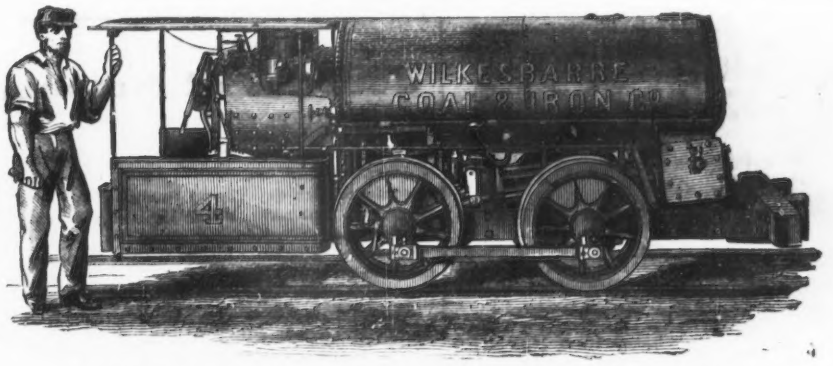

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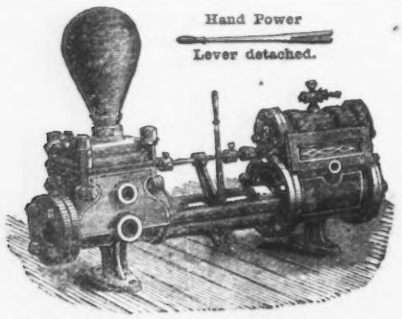

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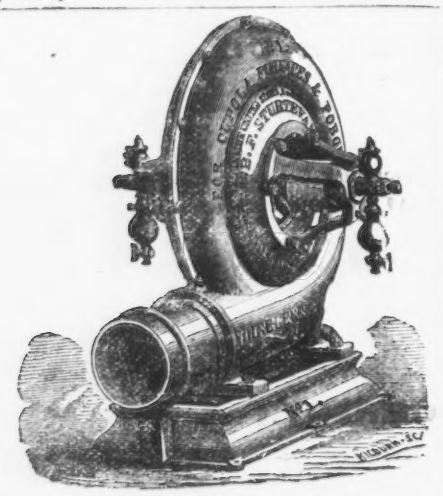

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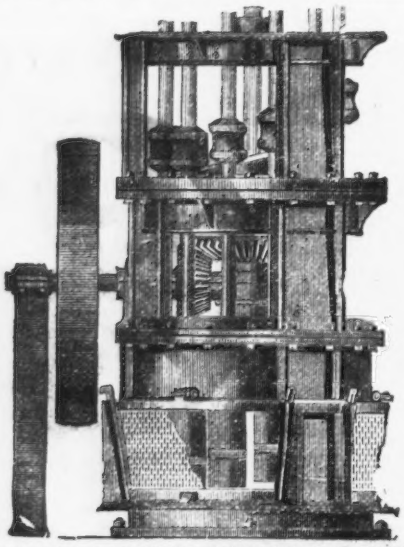

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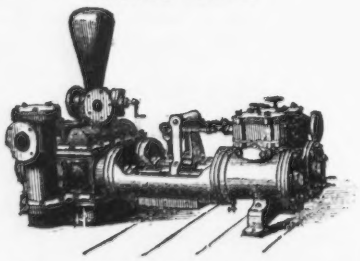

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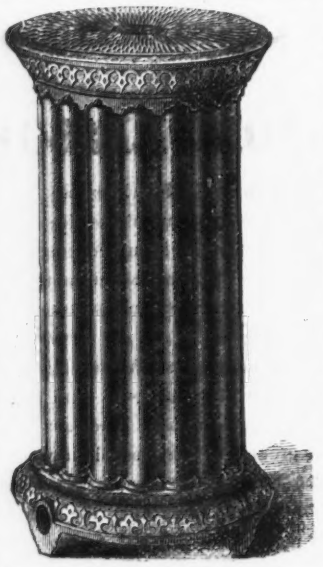

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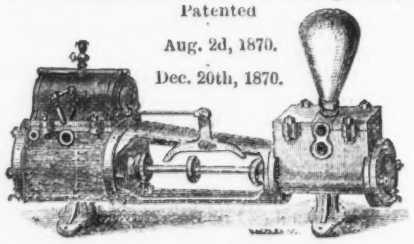

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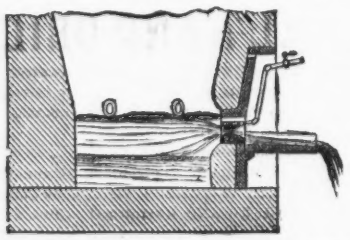

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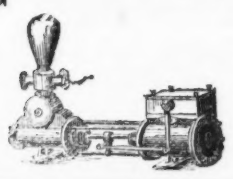

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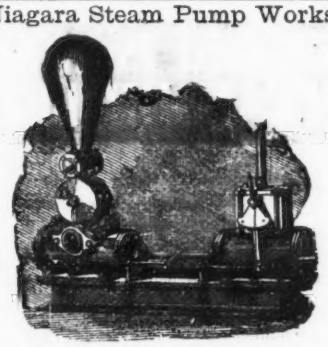

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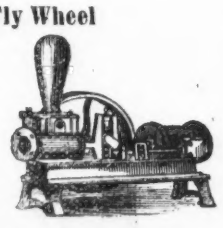

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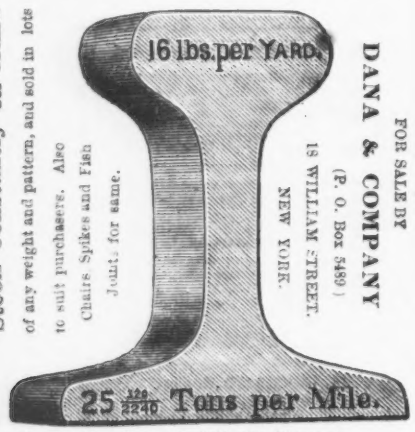

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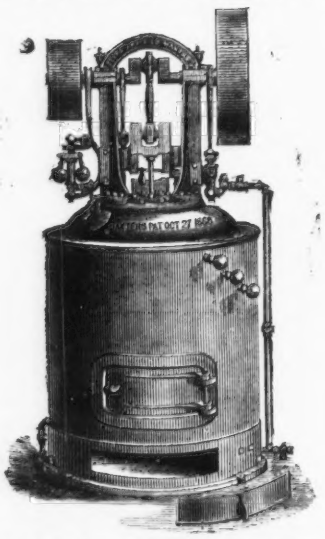

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